The Engineer

LONDON, FRIDAY, OCTOBER 2, 1942.

PUBLIC NOTICES

GLAMORGAN EDUCATION COMMITTEE

SCHOOL OF MINES AND TECHNOLOGY, TREFOREST

Principal: ROBERT JAMES, Wh.Sc., A.R.C.S., D.I.C., A.M.I. Mech. E.

Applications are Invited for the following Full-time TEACHING POST. ties to commence 1st January, 1943.
HEAD of ENGINEERING DEPARTMENT chanical and Electrical). Salary £540, rising £600. Applicants should possess a good ours Engineering Degree, with teaching and ustrial experience. Preference will be given candidates with experience in Teaching to andard of Final B.Sc. Engineering.
Applications forms (and particulars of duties), ich must be returned not later than the 12th tober, may be obtained by forwarding a mped, addressed foolscap envelope to the dersigned.

F. E. REES,
Director of Education.

Glamorgan County Hall,
Cardiff. 8806

SITUATIONS OPEN

PIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

ADVERTISERS UNDER BOX NUMBERS IN SITUATIONS OPEN SECTION.

For the benefit of applicants, the Proprietors prepared to insert brief notices that vacancies filled, upon receipt of notifications from the vertisers. These notices (limited to one line) ll be free of charge, and co-operation is rd for.

IMPORTANT

Advertisers in Situations Open Column ould make themselves acquainted with terms of

STATUTORY RULES & ORDERS 1941 No. 2069

STRICTION ON ENGAGEMENT ORDER

CHIEF MAINTENANCE ENGINEER, to Control all Repairs, Mechanical and Elec- al, and Maintenance and Installation of Plant. Address, 8812, The Engineer Office. 8812 A

ENGINEER INVESTIGATOR WANTED for important N. of England Manufacturing mpany. Good salary, permanency with spects. Must have sound training and expe- nce in Mechanical, Electrical, Steam and draulic Engineering. The ideal man will be ter 40, but capable of solving big problems in tory process control, plant lay-out and machine sign. He must be a good team worker. Inter- ws given any time and place. Strictest con- nce observed.—Give full particulars and ary expected, with three good references, to x No. 613, L.P.E., 110, St. Martin's Lane, ndon, W.C.2. 8805 A

FACTORY SUPERINTENDENT WANTED (Scotland). Modern plant. Exceptional portunity for engineer with ambition and itiative. Experience in Quantity Production Medium-size Components essential. Permanent pointment. Superannuation. Replies treated confidence. Interview expenses paid. Age, perience, and salary.—Address, 8793, The gineer Office. 8793 A

GENERAL ENGINEERING WORKS Have a VACANCY for a MANAGER of their chine, Fitting, and Assembly Shops. Largely ntract jobbing work of urgent priority, with a ain amount of batch production. Shops uipped with large modern machine tools and ploying 300—male and female.
Applicants must be conversant with latest chine Shop Practice, including Rate Fixing d Planned Production; preference will be ven to those having previous experience in a ilar managerial capacity. Permanent situation th good prospects.
Please state particulars of age, experience, and lary required.
Address, 8799, The Engineer Office. 8799 A

WORKS MANAGER WANTED, to Take Full Charge, directly under Managing Director, a Small Engineering Works in the County of rks, employing under 50 operatives and gaged exclusively on work of national import- ce, comprising Press Work, Sheet Metal Work, elding and Brazing, Sand Blasting and Paint raying. A liberal salary will be paid to a mpetent and energetic man possessing the cessary qualifications.—Applications, which ill be treated in strict confidence, stating full rticulars as to age, qualifications, references, d salary expected, by letter to "L. T. L.," o J. W. Vickers and Co., Ltd., 7/8, Gt. Winchester Street, London, E.C.2. 8813 A

The Engineer

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NOTICE

CORRESPONDENCE *re* Accounts and Remittances should be sent in future to:

28, ESSEX STREET, STRAND, LONDON, W.C.2, and NOT to Bath.

This change has been caused by enemy action, and co-operation is earnestly asked for.

SITUATIONS OPEN

SHOP MANAGER REQUIRED by Light Engineering Firm, 100 employees. Only thoroughly practical men need apply. Cotswold area. Salary £8 p.w. plus bonus. Good prospects.—Address, 8824, The Engineer Office. 8824 A

THE Post You are Seeking May Not be Advertised in this Column, but do not lose the Opportunity of Bringing your Requirements before all those who would be interested and could employ you. An Advertisement in the "Situations Wanted" Column would be seen by all Leading Engineering Concerns for the cost of Four Lines, 6s.; 1s. 6d. for each Additional Line. There is no better way of covering so large a field for such a small charge.

SITUATIONS OPEN

CHIEF WELDING ENGINEER REQUIRED for Modern Factory in Manchester area, engaged on Heavy Arc-welded Products. Required to take complete charge of a department and to develop important new war product. Must be expert in Spot, Projection, and Flash Butt Welding procedure. Permanent position assured for the right man.—Address, stating experience, age, and salary required, 8795, The Engineer Office. 8795 A

REPRESENTATIVE REQUIRED to Cover Greater London, Selling De-scaling Solution and Boiler Water Treatment. Terms in salary and commission.—Address, giving fullest details as to past experience, &c., 8815, The Engineer Office. 8815 A

SITUATIONS WANTED

ADVERTISER (Personnel Manager), Pre-war trained, also M.O.L. and J.E.B. (Local Government) experience, available near future, any area, permanent post-war POSITION with large undertaking REQUIRED. Reorganise if necessary. Salary £600 to £800.—Address, P4404, The Engineer Office. P4404 B

CHARTERED CIVIL ENGINEER (Over Age), with extensive business experience, administration, management, negotiation, distribution, sales, &c., SEEKS PART or WHOLE-TIME EMPLOYMENT. Could manage London office, assist managing director, or replace director called up.—Address, 8804, The Engineer Office. 8804 B

ENGINEER, Age 48, as TOOLROOM FOREMAN. Press work, machine shop and machine tool experience. North London district preferred.—Address, P4407, The Engineer Office. P4407 B

ENGINEER (37), Shops, D.O., Erection, Rep., structural training, but adaptable, good organiser, SEEKS WORK of National Importance, London area; £450.—Address, P4405, The Engineer Office. P4405 B

ENGINEER (48), Disengaged, REQUIRES POST; 20 years works manager, heavy industry, maintenance or production.—Address, P4399, The Engineer Office. P4399 B

ENGINEER (46), Honours Degree, Extensive experience, estimating, purchasing, and supervising contracts for engineering plant, home trade and export, DESIRES EXECUTIVE POSITION, London area. Salary £600/£800 p.a. —Address, P4401, The Engineer Office. P4401 B

FUEL ECONOMY—LONDON AREA.—Experienced POWER ENGINEER OFFERS his ADVISORY SERVICES to Power Users.—Address, 8828, The Engineer Office. 8828 B

GENERAL MANAGER, Fully Experienced, commercial, sales, highest technical qualifications, complete knowledge engineering steel works, foundry, ferrous and non-ferrous trades, also light alloys, production planning, and tooling, present salary four figures, Age 44, OPEN for RE-ENGAGEMENT.—Address, P4380, The Engineer Office. P4380 B

IF the Man You Are Seeking is Not Amongst those Advertising in this Column, a Small Announcement in the "Situations Open" Column will Quickly and Economically Produce the Right Selection of Applicants, at the same time Eliminating Waste of Effort, Waste of Time, and Waste of Opportunity. The charge is Four Lines or under, 6s.; each Additional Line, 1s. 6d. Box Numbers, 1s. extra, which includes despatch of all replies.

MAINTENANCE ENGINEER, Steam, Electric, Refrigerating; 15 years marine seagoing chief engineer; age 58. Salary £300-350. Any district.—Address, P4378, The Engineer Office. P4378 B

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CLASSIFIED ADVERTISEMENTS CLOSE FOR
PRESS-NOON WEDNESDAYS

The Engineer

Annual Subscription Rates

(including postal charges)

BRITISH ISLES	£3	5	0
CANADA	£2	18	6
ABROAD...	£3	3	0

(except Canada)

ADVERTISEMENTS

The Charges for Classified Advertisements are 1/6 per line up to one inch—minimum charge, 6/-; those occupying one inch or more at the rate of 18/- per inch. Box numbers, 1/- extra, except in the case of advertisements under "Situations Wanted." Orders MUST be accompanied by a remittance. The rates for Displayed Advertisements will be forwarded on application. Classified Advertisements cannot be inserted unless delivered before TWO o'clock on Wednesday afternoon.

Letters relating to the Advertisement and the Publishing Departments of the Paper are to be addressed to the Publisher; all other letters are to be addressed to the Editor of THE ENGINEER.

Postal Address,
28, Essex Street, Strand, London, W.C.2.

Teleg. Address,
"Engineer Newspaper, Estrand, London."
Tel., Central 6565 (10 lines).

SITUATIONS WANTED

POSITION REQUIRED, General or Works Manager in Medium, Heavy or General Engineering works, preferably South, employing up to 1600 employees.—Address, P4397, The Engineer Office. P4397 B

PRACTICAL ENGINEER REQUIRES RESPONSIBLE POST. Technical commercial experience, manager, supervisor, representative; over military age.—Address, 8830, The Engineer Office. 8830 B

RESEARCH.—Fully-qualified MECHANICAL ENGINEER, specialising in design, construction, and operation of research instruments, apparatus, DESIRES POST in London.—Address, P4367, The Engineer Office. P4367 B

TRAINED ENGINEER, Exempt Military service, 33 years' experience travelling British Isles as technical representative for well-known engineering firms, AVAILABLE for POST, work of national importance.—Address, P4398, The Engineer Office. P4398 B

WORKS MANAGER or SUPERINTENDENT. Advertiser, aged 44, public school, engineering pupilage, life experience, machine shop, planning, tooling, inspection, stage production; free September 30th, now works superintendent, six-pounder production. Salary £800 plus production bonus. A.I.D. and C.I.A. requirements. Released on personal grounds.—Address, 8831, The Engineer Office. 8831 B

DRAUGHTSMAN (23), Low Medical Grade, AVAILABLE for more ESSENTIAL WORK. Four years' structural and some mechanical experience, two years workshops. Would learn new work in D.O., computing or other technical dept. very quickly.—Address, P4400, The Engineer Office. P4400 B

PARTNERSHIPS

CAPITAL.—ADVERTISER Has CLIENTS with £2000 to £10,000 each wanting Directorships of new or established Companies.—Address, 8823, The Engineer Office. 8823 C

SUB-CONTRACTING

WANTED

ADVERTISER will EXECUTE FACTORY "LAY-OUTS," EXTENSIONS, ALTERATIONS and COMPLETE INSTALLATIONS if interested firms will communicate.—Address, P4365, The Engineer Office. P4365 MW

DRAWING OFFICE Now Has CAPACITY for additional DESIGNING, DETAILING, and TRACING. Specialising in power plant, factory lay-out, and mechanical details.—Address, P4402, The Engineer Office. P4402 MW

ENGINEER'S BRANCH OFFICE MANAGER could UNDERTAKE additional WORK. Tech. rep. with office in London. Only firms with established connection considered.—Address, P4406, The Engineer Office. P4406 MW

LIGHT PRESSINGS and STAMPINGS WANTED in all metals; 20-Ton presses.—COMMERCIAL STRUCTURES, Ltd., Staffa Road, Leyton, E.10. 8774 MW

MACHINING WORK REQUIRED, Large or small lots, suitable for Centre Lathes (9in. crs. by 8ft.), Slotters, Drills, Shapers, Planers, &c.—STRINGERS, Ltd., Wincobank, Sheffield. 8084 MW

POWER and HAND FORGING WORK WANTED, up to 3in. sq.—COMMERCIAL STRUCTURES, Ltd., Staffa Road, Leyton, E.10. 8772 MW

PRECISION TUBE and BAR BENDING WORK WANTED.—COMMERCIAL STRUCTURES, Ltd., Staffa Road, Leyton, E.10. 8773 MW

PROFILING WORK WANTED.—COMMERCIAL STRUCTURES, Ltd., Staffa Road, Leyton, E.10. 8771 MW

MISCELLANEOUS

AS Mr. Eden Says in "The Times" on 28/9/42, "None of us can now escape from revolutionary changes." Active planning is proceeding overseas to-day for post-war internal industrialisation. ADVERTISER, South African, recently arrived, highest credentials, experienced engineer negotiator, free to "come and go," is PREPARED to JOURNEY to and from SOUTH AFRICA for the purpose of PLANNING MANUFACTURING FACILITIES in the Union. Progressive and far-sighted principals invited to write.—Address, 8833, The Engineer Office. 8833 I

FIRM, Engaged in Light Engineering, WISHES to CONTACT INVENTORS desiring to commercialise their inventions.—Address, 8821, The Engineer Office. 8821 I

AGENCIES

LONDON REPRESENTATION.—CITY MAN, with well-equipped offices, staff, telephones, typewriters (40 years' occupation), would be PREPARED to ACT in the above CAPACITY for large provincial firm. Immediate availability.—Write W. HUCKIN, 5, St. John Street, London, E.C.1. P4396 D

MACHINERY, &c., WANTED

WANTED, a NUMBER of TEE-SLOTTED BED-PLATES or MACHINE TABLES.—THOMAS MITCHELL and SONS, Limited, Bolton. P4376 F

WANTED, ONE 6in. by 6in. ANGLE CROPPER, "Pels" type. Full particulars.—Address, 8832, The Engineer Office. 8832 F

WANTED, TWO Electric or Petrol-driven Lister AUTO. TRUCKS or other good make.—Address, 8775, The Engineer Office. 8775 F

WANTED, BENDING ROLLS, Swing End, 14ft. long by ¾in. plates. Full particulars.—Address, 8817, The Engineer Office. 8817 F

WANTED, CIRC. COLD SAWING MACHINE, cap. of cutting up to 6in. or 8in. brass billets. Full particulars.—Address, 8818, The Engineer Office. 8818 F

WANTED, ONE Motor-driven HACK SAWING MACHINE for dealing with rounds up to 10in. dia. and also capable of cutting 15in. by 6in. joists and 15in. by 4in. channels. Full particulars.—Address, 8827, The Engineer Office. 8827 F

WANTED, TWO Double-ended Slide BOLT HEADING MACHINES for ¾in. to 1in. bolts. Full particulars.—Address, 8825, The Engineer Office. 8825 F

ALFRED HERBERT, Ltd., Coventry, PAY BEST PRICES FOR SECOND-HAND MACHINE TOOLS in good condition by first-class makers.
Write, wire, or 'phone, and our representative will call.
'Phone: 88781 (12 lines), Coventry; Telegrams: "Lathe, Coventry." 1002 F

ALL CLASSES of MACHINE TOOLS WANTED, cash paid.—NORMAN POTTS, 105, Alcester Road South, King's Heath, Birmingham, 14. 8765 F

We are licensed by the Machine Tool Control for the purchase of all classes of Machine Tools, and we offer good prices for surplus Machinery in any quantities, large or small.

F. J. EDWARDS, LTD.
359, EUSTON ROAD, LONDON, N.W.1
Telephone No.: EUSton 4681
Telegrams: "Bescotools, Norwest, London."

EDUCATIONAL

AUTHORITATIVE CORRESPONDENCE TRAINING

25 FIRST PLACES

and HUNDREDS OF PASSES in the A.M. Inst. C.E., A.M.I. Mech. E., A.M.I. E.E., A.F.R.Ae.S., A.M.I. Chem. E., C. & G., etc., Examinations have been gained by T.I.G.B. Students.

Especially in view of Air Raid and Working Conditions, study at home with the T.I.G.B. in order to achieve the best progress and results. Write to-day for "The Engineer's Guide to Success"—FREE—containing the world's choice of Engineering Courses—over 200—covering all branches and recognised qualifications. Mention branch, post of qualifications that interests you. The T.I.G.B. guarantees training until successful.

THE TECHNOLOGICAL INSTITUTE OF GREAT BRITAIN
70, TEMPLE BAR HOUSE, LONDON, E.C.4.

FOR SALE

FOR DISPOSAL, NEW STANDARD PROTECTED TYPE, CONTINUOUSLY RATED, SLIP-RING INDUCTION MOTORS, wound for operation off a 400/440 volts, three-phase, 50 cycles supply. Each with one new set of slide rails and one new hand-operated, oil-immersed rotor and stator starter, fitted with no-volt and three overloads. One 50 H.P. at 1500 r.p.m., at £132 16s. at our works; one 40 H.P., 1000 r.p.m., at £125 10s. at our works; one 30 H.P., 750 r.p.m., at £112 10s. at our works. Available for immediate dispatch.
STANLEY ENGINEERING CO., Bath. Telephone 4294; telegrams, "Trius." 8819 G

FOR DISPOSAL, Good SECOND-HAND LANCASHIRE BOILER STORAGE TANK, which is approximately 30ft. long by about 8ft. diameter, having an approximate capacity of 9400 gallons.—STANLEY ENGINEERING CO., Bath (telephone, 4294; telegrams, "Trius"). 8702 G

FOR DISPOSAL, ONE Good SECOND-HAND LANCASHIRE BOILER, by E. Danks and Co., Ltd., which is approximately 30ft. by about 8ft. 6in. diameter, suitable for 100 lb. working pressure. Chimney or feed pump not included. Made about 1925.
STANLEY ENGINEERING CO., Bath. Telephone, 4294; telegrams, "Trius." 8724 G

FOR SALE, Low Price Before Dismantling.—High Temperature Conveyor Type ENAMELLING PLANT, by Controlled Heat and Air, Limited, 59ft. by 7ft. wide by 5ft. high oven. DIP TANK, 7ft. by 3ft. 6in. by 5ft. Oil-fired HEATER with automatic control. Full details and arrangement to view.—Address, 8820, The Engineer Office. 8820 G

FOR SALE.
6000-kilowatt B.T.H. TURBINE SET and CONDENSER. Details as follows:—
6000-kilowatt (7500 kW, C.M.R.) Turbine, 200 lb. pressure, 50 deg. F. total, 6600 volts, 3-phase, 50 rty., 1500 revs., 11.25 lb. F.L., 28.8in. vac.
Direct-coupled Exciter.
Worthington Simpson Condenser, 72,000 lb. per hour, 8250 square feet surface, 6000 galls. per min. at 50 deg. F.
Circulating Water Pumps, 5520 g.p.m., 25ft. head, with 78 H.P. Motor, 440 volts, 3-phase, 50 rty., 1440 revs.
Condensate Pumps, 150 g.p.m. at 55ft. head, with 70 H.P. Motor, 440 volts, 3-phase, 50 rty., 1440 revs.
Rotary Air Pump and Operating Pumps to remove 55 lb. of air per hour, vacuum 29.8in.
All the above at present with certain valves, pipe work and girder work for foundations, as lying.
OFFER SUBJECT TO REMAINING UNSOLD.

THOS. W. WARD LTD.
ALBION WORKS, SHEFFIELD.
Telephone, 26311 (15 lines).
8826 G

For continuation of Small Advertisements see page 60.

Vertical Milling Machines
all geared, hardened and ground throughout, ball and roller bearings, swivelling head, 30"x8" Table
HENRY MILNES LIMITED, Machine Tool Works Ingleby Street, BRADFORD

THE standardised card advertisements below are inserted in place of the firms' large advertisements which have been omitted due to the paper shortage.

Crossley Brothers Ltd.
Openshaw, Manchester, 11
Crossley-Premier Engines Ltd.
Sandiacre, Nr. Nottingham
See our displayed advertisement SEPTEMBER 25

ALFRED HERBERT LTD.
COVENTRY
See our displayed advertisement on Page 13

ROBERT HUDSON LTD.
LEEDS
See our displayed advertisement SEPTEMBER 25

The Hunslet Engine Co. Ltd.
LEEDS
See our displayed advertisement SEPTEMBER 4

LAFARGE ALUMINOUS CEMENT Co. Ltd.
THE KILNS, RIPLEY, SURREY
See our displayed advertisement SEPTEMBER 18

NOBLE & LUND LTD.
FELLING-ON-TYNE
See our displayed advertisement SEPTEMBER 18

Rose, Downs & Thompson Ltd.
HULL and LONDON
See our displayed advertisement SEPTEMBER 18

CRAIG & DONALD LTD.
(Scottish Machine Tool Corporation Ltd.)
JOHNSTONE, Nr. GLASGOW
See our displayed advertisement SEPTEMBER 25

SIGMUND PUMPS (Great Britain) Ltd.
TEAM VALLEY, GATESHEAD-ON-TYNE
See our displayed advertisement SEPTEMBER 4

STOTHERT & PITT LTD.
BATH, ENGLAND
See our displayed advertisement SEPTEMBER 18

THE UNITED STEEL COMPANIES LIMITED
SHEFFIELD
See our displayed advertisement SEPTEMBER 25

VICKERS-ARMSTRONGS Ltd.
Vickers House, Broadway, London, S.W.
See our displayed advertisement AUGUST 7

The Wellman Smith Owen Engineering Corporation Ltd.
Victoria Station House, Victoria St., London
See our displayed advertisement SEPTEMBER 18

ARMSTRONG, STEVENS & SON, LIMITED
Walsall Road, Willenhall, Staffordshire
Manufacturers of
SPANNERS AND DROP FORGINGS.

J. W. & C. J. PHILLIPS LTD.
Manufacturers of Pattern Shop Equipment
Pomeroy Street, New Cross, London, S.E.14
See our displayed advertisement SEPTEMBER 4

CLYDE CRANES
For STEELWORKS, HARBOURS, SHIPYARDS AND DOCKS, LEVEL LUFFING CRANES. (JARDINE PATENTS.)
CLYDE CRANE AND ENGINEERING CO.
MOSSEND, Near GLASGOW.

TANKS
GALVANISING & CONSTRUCTIONAL IRONWORK
JOSEPH ASH AND SON, LTD.
Ren Street South, BIRMINGHAM.

MORRIS BOILERS
Herbert Morris' Ltd Loughborough

A Seven-Day Journal

British Shipbuilding and Ship Repairing

On Wednesday, September 23rd, well over 1000 representatives of the employers and workmen engaged in the shipbuilding industry attended a conference held in London to hear addresses from Mr. Bevin, the Minister of Labour, and Mr. A. V. Alexander, the First Lord of the Admiralty, on the present position of British shipbuilding and ship repairing. Previously both of these gentlemen had addressed a smaller body of trade union leaders and shipbuilding employers. The conference was held in private and was attended by senior naval officers. In a message to the conference, Mr. Winston Churchill, the Prime Minister, said that, although the shipping position had recently improved, it was still very grave, and we were in urgent need of every ship that could be built. While expressing the pride of the British Government in the work which had already been accomplished, Mr. Churchill appealed to all to strive their utmost. The speeches made by Mr. Bevin and Mr. Alexander were, we understand, well received, and in the discussion which followed a number of the men's leaders mentioned some of the difficulties which had arisen in some of the shipyards. The following resolution was passed unanimously:—"That this conference, representative of all sections of the shipbuilding and ship repairing industry, drawn, as it is, from every district in the country in which ships are built and repaired, hereby pledges itself to ensure by every means in its power still greater output of all classes of work, and the still speedier delivery of new ships, and the quicker return to service of those which come to the industry in need of repair."

The Government's New Building Contract

At a special general meeting of the National Federation of Building Trades Employers, held in London on Thursday, September 24th, it was unanimously decided to instruct members of the Federation not to accept the new standard form of Government contract, pending negotiations with the Government Departments concerned. The Federation of Civil Engineering Contractors has issued similar instructions. Letters announcing this decision have been sent by both Federations to the Ministers of the Government Contracting Departments. The following memorandum on the subject is issued jointly by the National Federation of Building Trades Employers and the Federation of Civil Engineering Contractors:—"The Contracts Co-ordinating Committee of the Government Contracting Departments has introduced a new form of contract conditions for Government building and civil engineering works. The National Federation of Building Trades Employers and the Federation of Civil Engineering Contractors, though they fully accept the Government's view that a new single form is desirable, have represented to the Ministers concerned that the new form, upon which the industrial organisations have not been consulted, is based upon principles which they regard as very unfair. By way of example, it would deny all right of appeal to independent arbitration upon fundamental matters, with the result that on these matters the officials of the Government Departments would be left, as judges in their own cause, with autocratic powers, not only to administer, but also to interpret the contract, contrary to general industrial practice. Another example is that, if the works or buildings develop faults or failures by reason of errors in the design, the responsibility for the mistakes of the Government Departments' designers is placed upon the contractor. So seriously do the Federations regard this new action by the Government Departments that they have instructed their members to make it clear, when tendering for Government work, that their tenders are subject to adjustment of the terms of contract in a manner to be agreed with the Government Departments. In issuing this instruction the Federations have made it quite clear that on no account must there be any holding up of Government work at this time, and that in every case the actual work must be started immediately and carried out with the utmost possible expedition; but they do maintain that the Government should give effect to the democratic principle of collective bargaining, and the right of the Federations to discuss and agree with the Government Departments the conditions of contract which their members are to be asked to sign."

The Road Haulage Scheme

At two meetings of road hauliers, which were held in London on Wednesday, September 23rd, criticism was made of the Government's road haulage scheme on the ground that there was not a complete understanding between the Government and the industry. In his Presidential Address to the National Road Transport Employers' Federation, Mr. J. Turner said that the essential feature of the scheme was a complete partnership between the Ministry and the industry. That partnership had, he claimed, not materialised. He added that when he addressed the Federation nearly a year ago he had urged full support of the scheme, with the honest conviction that, given mutual goodwill and co-operation, it would succeed. Nothing had happened to change that view, and he was still of opinion that if the partnership between the Ministry and the industry, which once seemed so promising, could be brought about, then the scheme would yet succeed. Some time before the war was finished, perhaps to-morrow, the need for road transport would undoubtedly arise again with the same or even greater urgency. Whatever might be said about the scheme or its failure, road transport would never fail. The support and co-operation of each one of the 60,000 operators was needed, and would still be forthcoming without hesitation, if the right methods were adopted. Speaking at the annual meeting of the British Road Federation, on Wednesday, September 23rd, Mr. George N. Wilson, the Chairman of the Federation, said that the Government had recently announced that the road haulage scheme was now being reviewed.

Fuel Economy in Industry

Speaking in Nottingham last week, Major Lloyd George, the Minister of Fuel and Power, stated that if it were possible to run this country without railway transport, we should just about balance the coal deficit. He stated that the nation's estimated coal consumption this year exceeded the present rate of production by 250,000 tons a week, or 13,000,000 tons over the whole year. Industry, he said, must regard fuel economy as its first priority job. On Thursday, September 24th, a meeting took place in London between the Fuel Efficiency Committee of the Ministry and representatives of more than thirty trade associations. The associations represented covered industries which consume in the aggregate more than 25,000,000 tons of coal each year. Among the matters which were discussed at the meeting were the duties and status of fuel efficiency officers, who are being appointed in the majority of factories all over the country. Methods of measuring fuel consumption per unit of product were also considered, in order to provide a "yardstick" for the assessment of fuel efficiency in each industry. The payment of bonus to workmen in order to encourage fuel saving was also discussed. It was reported that the scheme for training fuel efficiency officers and boiler firemen was in full swing. Lecture courses are again to be held during the autumn and winter months, and will start within a few weeks at more than sixty different centres. The recommendation was made that in every firm someone possessing a knowledge of fuel should be appointed to act as a fuel officer or "fuel chaser." In order to increase the production of coal it has been decided that all young men still in industry, who were under twenty-five at the time of registration, and who are now being set free to join the Forces, may choose instead to take underground employment in mining work. The option has been extended not only to coal mining, but to tin, iron ore, oil shale, and gypsum mining. The option does not apply to young men who, when in the Forces, would continue to follow their trade there.

Interchange of British and American Patent Rights

On Saturday last, September 26th, a White Paper was published giving the text of an agreement reached between the British and American Governments concerning the interchange of patent rights and technical information. The basic principle of the agreement is that each Government undertakes at its own cost to obtain from its own nationals such information and manufacturing rights as the other Government requires. An Order in Council, amending the Defence (Patents, Trade Marks, &c.) Regulations, 1941, was made on Thursday, September 17th, in order to facilitate the operation of the new British and United States agreement. It is pointed out that it is not now permissible for a British subject resident in America to enter into any agreement respecting the use of an invention, discovery, or design in the United States of America, without a permit from one of the Government Departments specified as "competent authorities" for the purpose of the Order, and powers are also conferred upon these Departments to require licences to be granted in such form as may be directed. Where such licences are required, the Order recognises a right to compensation. It is contemplated that the compensation, if not settled by agreement, will be determined by a tribunal, analagous to the Royal Commission on Awards to Inventors, which was set up in connection with the last war, and which will deal also with claims for the use of inventions by the Crown. The Government Departments, which are specified as competent authorities in the Order, are the Admiralty, the Ministry of Supply, the Ministry of Aircraft Production, and the Department of Scientific and Industrial Research, and it is understood that these Departments will collaborate as may be necessary in the matters of granting permits and giving directions for the granting of licences.

The New U.S. Aircraft Carrier "Lexington"

On Saturday last, September 26th, the new United States Navy aircraft carrier, the new "Lexington," took the water at the Bethlehem Steel Company's Shipbuilding Division Yard at Quincy, Mass. The ship, which was earlier called the "Cabot," is of the "Essex" class and was launched about one year ahead of schedule. She was named by Mrs. Theodore Douglas Robinson, who seventeen years ago named the first "Lexington." The construction of this large ship almost a year ahead of time has created a new record in American naval construction. The yard at which she was built was bare ground only eighteen months ago, and she was launched fifteen months after the keel had been laid. Among those who attended the launching ceremony were Rear-Admiral Frederick Shearman, who commanded the first "Lexington," and several Naval Air Arm men, who had flown from the decks of the old ship when she was sunk in the Coral Sea Battle in June last. According to the particulars given in the latest edition of Jane's "Fighting Ships," aircraft carriers of the "Essex" class have a displacement of about 25,000 tons, and will carry a ship's complement of over 2000 officers and crew. The armour will be generally similar to ships of the "Enterprise" class and the guns mounted will include sixteen 5in. guns, besides several smaller-calibre guns in twin mountings. Provision will be made for carrying over eighty aircraft. The propelling machinery will consist of geared turbines, designed to give a speed of about 35 knots. The name ship of the class, the "Essex," was launched in June this year, and the estimated cost of these new aircraft carriers is given as about £15,000,000 each.

Delaware Aqueduct

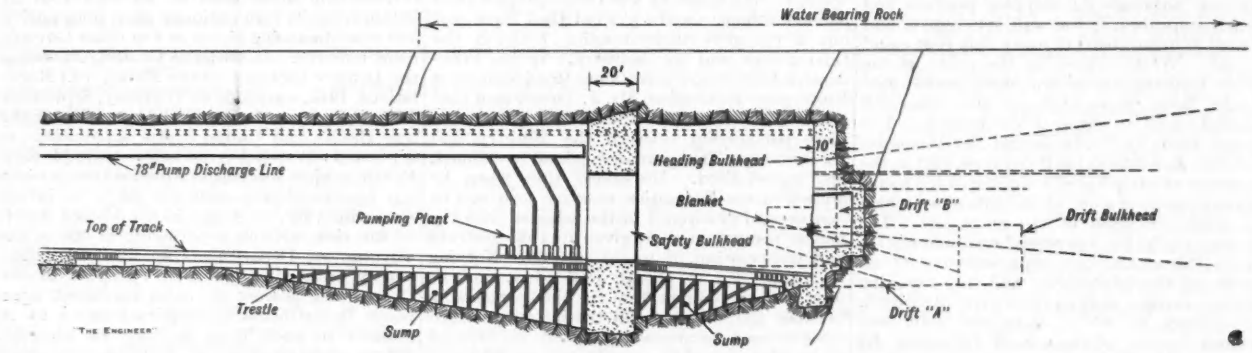
No. V—(*Continued from page 250, September 25th*)

Heading South from Shaft 2

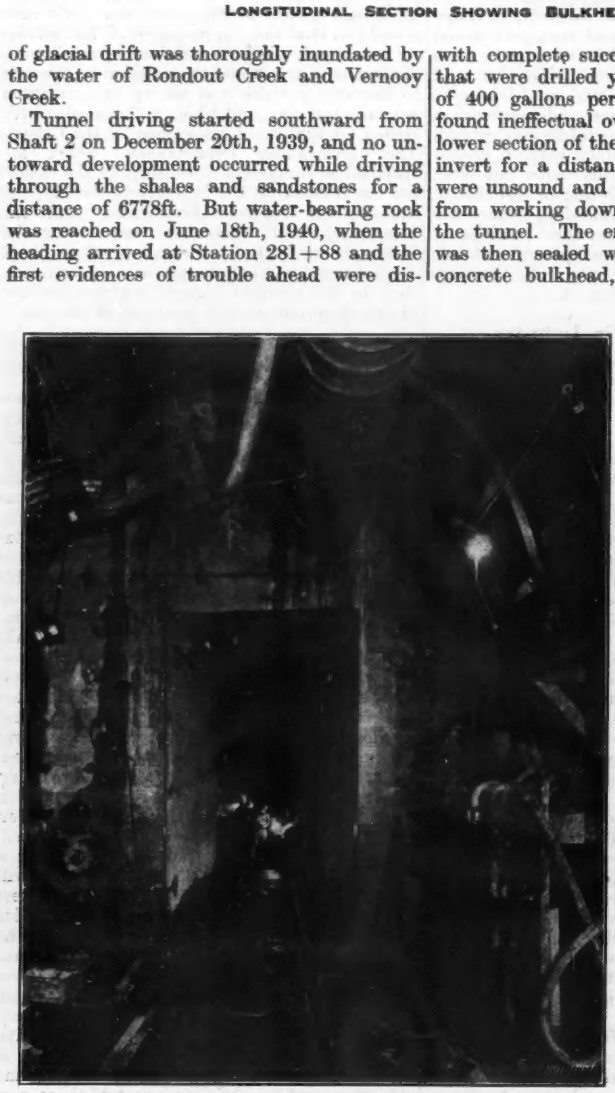
SHAFT 2 is located in the Rondout Valley where the ancient gorge has a width of about 3000ft. and the bed of Rondout Creek is composed of glacial drift that has a vertical thickness of 400ft. and in the underlying bed rock the aqueduct tunnel has a minimum rock cover 260ft. thick. That rock cover would have been ample had the rock been sound, which it was not, and the overburden of glacial drift was thoroughly inundated by the water of Rondout Creek and Vernooy Creek.

Tunnel driving started southward from Shaft 2 on December 20th, 1939, and no untoward development occurred while driving through the shales and sandstones for a distance of 6778ft. But water-bearing rock was reached on June 18th, 1940, when the heading arrived at Station 281+88 and the first evidences of trouble ahead were disclosed. The contractor had for some time been driving exploratory drill holes in the face, and at that station some of the holes yielded a flow of 400 gallons per minute. Grout pumps, held in readiness for just such an emergency, were brought into action and the holes were sealed after using 6160 bags of cement. The heading was then advanced 175ft. and into limestone, where other test holes gave an inflow of 150 gallons per minute. Again grouting was used, but not with complete success, and other test holes that were drilled yielded water at the rate of 400 gallons per minute. Grouting was found ineffectual owing to the fact that the lower section of the face and the rock of the invert for a distance out from the heading were unsound and could not keep the grout from working downward and outward into the tunnel. The entire face of the heading was then sealed with a heavily reinforced concrete bulkhead, 10ft. thick. The lower half of that bulkhead was supplemented by a bench or blanket of concrete, 18ft. thick longitudinally, the top of the bench being just below the springing line of the tunnel. The bulkhead was also reinforced with 60-lb. rails, arranged horizontally on 3ft. centres and keyed to the side walls of the tunnel. This sealed the unsound rock of the invert.

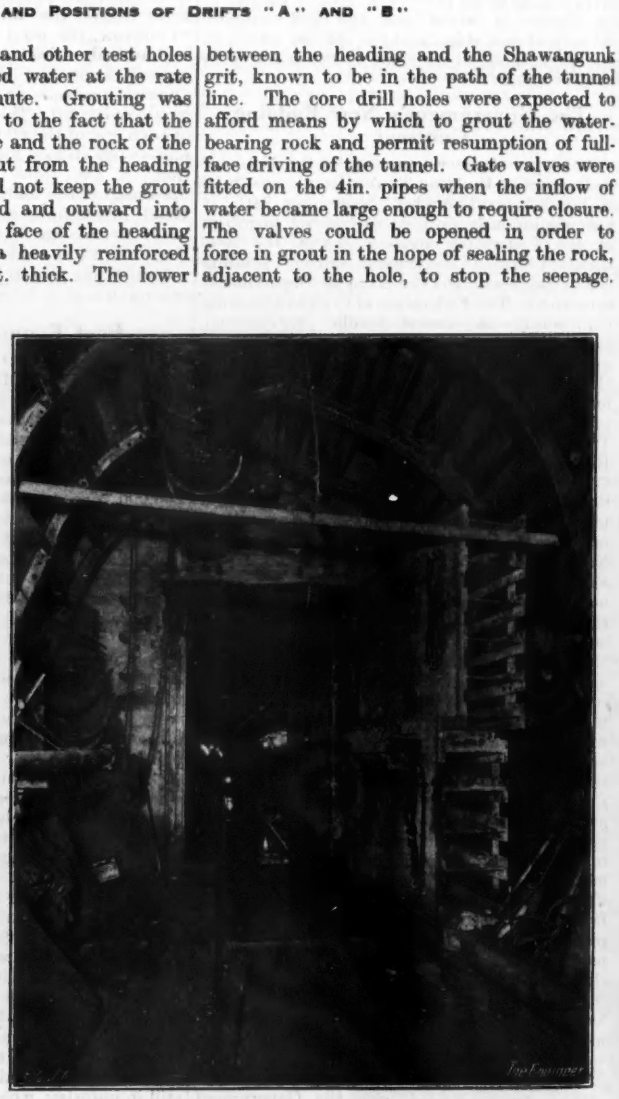
When the bulkhead and the bench were poured, 4in. steel pipes were embedded in the concrete to provide casings for core drilling, and other pipes, similarly placed, afforded controlled outlets for ground water behind the bulkhead. Core drilling was for the purpose of ascertaining the nature and condition of the rock ahead and to disclose how far the water-bearing formation extended between the heading and the Shawangunk grit, known to be in the path of the tunnel line. The core drill holes were expected to afford means by which to grout the water-bearing rock and permit resumption of full-face driving of the tunnel. Gate valves were fitted on the 4in. pipes when the inflow of water became large enough to require closure. The valves could be opened in order to force in grout in the hope of sealing the rock, adjacent to the hole, to stop the seepage.



LONGITUDINAL SECTION SHOWING BULKHEADS AND POSITIONS OF DRIFTS "A" AND "B"



SAFETY BULKHEAD FROM TUNNEL SIDE



SAFETY BULKHEAD FROM HEADING SIDE

Grouting pressures were from 1000 lb. to 2000 lb. per square inch. The static pressure of all inflowing water was found to be as high as 290 lb. per square inch, plainly indicating that the water came from Rondout Creek, which has its surface 650ft. above the tunnel line. The flow of water into the tunnel, before grouting, varied from 1000 to 2000 gallons per minute. Core drilling and grouting being unsuccessful in sealing the ground ahead, it became manifest that some other expedient would have to be devised to make possible a resumption of tunnel driving. At that stage a total of 1392 linear feet of drill holes had been driven behind the bulkheaded face, the holes having a maximum depth of 70ft.; and exploratory core boring, totalling 3189 linear feet, was done before one of the holes reached the Shawangunk grit, more than 500ft. in advance of the heading.

The next method of getting ahead took the form of an 8ft. by 8ft. drift that was driven from the lower left-hand quadrant of the bulkhead, after the removal of the blanket or bench. Before that drift was started, as a precaution against possibly still greater inflows of water through the drift, a bulkhead, 20ft. thick, was erected as a safety measure 73ft. back from the face. That bulkhead was well keyed into sound rock and had a rectangular passageway 6½ft. wide and 11⅛ft. high centrally placed with its sill at the tunnel floor level. A Dutch type steel door, in two horizontal sections, of massive construction, was hung on the advance side of the safety bulkhead. A 28in. vent pipe and all other necessary service pipes passed through the bulkhead, and a sump was excavated below the tunnel floor level on each side of the bulkhead; the one nearer the face was to take care of water that might flow rapidly from the working face, and the sump on the tunnel side of the safety bulkhead, having a capacity of 90,000 gallons, was to serve a pumping plant, placed immediately above, that had a total capacity of 7000 gallons per minute. In the tunnel, near the bottom of Shaft 2, nine Cameron centrifugal pumps were installed that had a total capacity of 9550 gallons per minute against a 1000ft. head. Those pumps carried all water from both the south and the north headings up to the ground surface.

Drift A, as the rectangular drift was designated, penetrated the rock but 87ft. when the leakage amounted to quite 2100 gallons per minute, and it became plain that drilling and grouting from that drift would not be effective in sealing the rock so that the full face of the tunnel could be driven. Drift A was then completely abandoned and filled solidly with concrete. A new method of dealing with the problem was then evolved by the contractors and the Board of Water Supply's engineers. This was a second drift, known as Drift B, and was started from the bulkhead at Station 283+53, and had its axis in the centre of the tunnel, 3ft. below the springing line. To promote drainage, Drift B sloped upward on a 1 per cent. gradient, was circular in section, and when lined with concrete having a minimum thickness of 18in. had an inside diameter of 7ft. In the lining invert were two 12in. drain pipes. Wooden forms were used in pouring successively the invert and arch of the lining, and the advance 5ft. of each driven section of the drift was temporarily left unlined to afford a sump for water coming in from the face and to lead the leakage to the drain pipes instead of over the concrete of the lined invert. This also afforded room at the heading for placing a bulkhead, when necessary, and for exploratory drilling and for the actual advance of the drift. The lining of the drift—familiarly spoken of as "the barrel drift," was tied into the concrete of the main heading bulkhead and to the contiguous rock, which was excavated to provide satisfactory anchorage. The concrete lining of Drift B had 18in. wide water stops, of ⅜in. steel plate, at each construction joint, and during its driving concrete bulkheads were erected in the drift at five points, namely, 20ft., 77ft., 111ft., 160ft., and 220ft. from its portal. The concrete lining therefore constituted a

HEADING BULKHEAD, DRIFT "A," AND POSITION OF DRIFT "B"

DRILLING GROUT HOLE FROM DRIFT "B"

HEADING BULKHEAD AND DRIFT "B"

solid barrier to outlying water except where not sealed for the time being by a face bulkhead. The drift was driven a total distance of 226ft. and closed at the last face with a concrete bulkhead 6ft. thick. While the drift was in process of driving a 36in. gauge track was laid on the lining invert, and all muck was hand loaded into regular muck cars reduced in height to afford suitable clearance. A small blower sent ventilating air into the drift through an 8in. pipe line.

Drift B permitted the contractor to drill radiating holes into the enveloping rock for the purpose of forcing grout into that rock to arrest the inward movement of water. The holes for that purpose were drilled through 3in. pipes embedded in the lining of a drift and radiating outward in a succession of ring-like formations, each ring having fourteen such pipes. Successive rings were spaced 4ft. apart longitudinally. To the inner end of each of the pipes was fitted a valve to shut off leakage before drilling and grouting were undertaken. Each drill hole extended radially to a depth 10ft. beyond the final maximum section, which was 24ft. in diameter in this zone of water-bearing rock. The drilling was done with two column-mounted drifters that used steels having 2ft. changes, the steels being assembled with sleeve couplings and equipped with jack bits. Drilling could thus be done within the limited diameter of 7ft. of Drift B. The lining of the drift was done with concrete containing high-early-strength cement that had a 2 per cent. content of calcium chloride, by weight. Grout made with the same cement and with from 16 to 45 gallons of water per bag of cement was used in sealing off the enveloping water-bearing rock. Grouting previously done from horizontal holes, before Drift B was driven, failed to disperse satisfactorily into the rock and so did not sufficiently check leakage.

To obtain a superior grout the mixing was done by agitating the cement and water with compressed air. The grout so prepared was better mixed than was possible with agitators of the paddle or any other type. The grout, when ready, was forced outward through the radial pipes and into the rock at a maximum pressure of 2000 lb. per square inch. Before that was done the rock was flushed with water at high pressure to remove, as far as practicable, any fine materials that might clog the rock passages and obstruct the infiltration of the grout. By means of radial grouting and the use of high-early-strength cement the water in the rock was brought under suitable control. The high-early-strength cement produced a grout that had a set volume of approximately 90 per cent., whereas the coarser Board of Water Supply cement gave a set volume of about 50 per cent. under the same conditions of water-cement ratio. In other words, the cement employed showed about 10 per cent. uncombined water, whereas the coarser cement carried about 50 per cent. uncombined water. It is true, of course, that the high-early-cement grout, while resulting in a larger volume per unit, was less dense and of lower strength than the other mixture, but the object was not to attain strength, but to close the water-carrying passages in the rock. The rock was not just sandstone and shale, but an unusual formation that contained limestone beds of varying thicknesses which were interspersed with solution cavities and water-bearing seams. The seams in some places were exceedingly thin and tended to arrest the admission of grout even while permitting the continual movement of ground water.

The grout used was the outcome of somewhat extensive laboratory testing, which was amply justified, because it enabled the contractor to master his difficulty. The maximum inflow of water at the south heading in Shaft 2 was 2000 gallons per minute, but had the contractor attempted to drive that section of the tunnel without recourse to the means he did employ it is estimated that the flow of water into the tunnel would have been anywhere from 20,000 to 40,000 gallons per minute. The barrel drift required three months and ten days from start to finish and from thence onward the enlarged tunnel section, 24ft. in diameter, was driven, as planned, by the full-face method; the entire stretch of this size from the bulkhead at Station 283+53 to its advance end was 750ft., long before the tunnel drivers met the Shawangunk grit. The 1in. steel interlining and the reinforced concrete backing of that lining, to rock, used 937 tons of plating and 313 tons of twisted 1¼in. square bars for reinforcing. Elsewhere on the contract the tunnel sections were excavated to diameters of 17ft. to 19ft., and the reinforcement generally required 6in., 18-lb., steel H beams for crown bar protection at the face and steel roof supports consisting of wall plates on which were erected on 4ft. centres and suitably braced 6in. H sections of 27·5 lb. for ribs. In all, 40,000,000 lb. of structural steel—*i.e.*, from 550 lb. to 600 lb. per linear foot of tunnel—was placed, and that steel had to be in position closely following the advance of a heading. This should be taken into account when evaluating the progress made. In connection with the steel support, the contractor used something like 1,120,000 board feet of lumber for blocking. Wide expanses of rock walls and roof areas were gunited to minimise air slaking of the rock. Regarding quantities, a total of 44,095 bags of cement were forced into the rock prior to the completion of the exploratory work, and a further 1838 bags of cement were used to consolidate the rock around the heading bulkhead at Station 283+53 before the first of the core-drilling was started there. In the grouting done from drift B 24,000 bags of cement were used.

(To be continued)

Canadian Locomotive Experiences

By EDWARD H. LIVESAY

No. V—*(Continued from page 253, September 25th)*

Transcontinental, Return: Calgary to Revelstoke, C.P.R.

FOUR trains leave Calgary for Vancouver daily. No. 1, a nameless stopping train (do not take it if you are in a hurry!); No. 13, "The Mountaineer," from Chicago; and Nos. 3 and 7, the two sections of "The Dominion." There used to a fifth, "The Trans-Canada Limited," which had a largely undeseved reputation as a flyer, and sometimes still trades on it, in spite of the fact that it was withdrawn in 1930, killed by "The Depression," and in any case was probably no faster than "The Dominion." Certainly it was no faster than "The Dominion" is now; on the contrary, it took 3 days 21½ h. to cross the continent from Montreal to Vancouver, as against "The Dominion's" present schedule of 3 days 12 h.

This account is concerned with No. 3, the first section of "The Dominion," which is due out of Calgary at 8.30 a.m., and on this occasion was made up of fourteen cars, say, 1100 tons, actually leaving 13 min. late. It was a fine summer day and the engine was "No. 5925," one of the latest booster-equipped 2-10-4s, in charge of enginemen Flegal and MacQuestion. The start, with the considerable load, was smooth and easy, which perhaps is only to be expected when an engine has 160 tons available for adhesion and the T.E. is 89,000 lb.—considerably more than the equivalent of two L.N.E.R. 2-8-2s. The booster naturally did its part; it is always in good starting condition, as it can run in neutral to warm up before being cut in. The gradient towards the mountains begins at once on leaving Calgary, and the engine got away on half throttle and 30 per cent. cut-off, once on the move, with the pressure a little down to 250 lb.—285 lb. is the working figure. Clear of the town, sand was fed through the fire-box, to clean off the oil fuel deposit that settles in the tubes. This is best done when the engine is working hard on an up gradient. The pressure rose steadily, until at Cochrane, the first stop, 23 miles, it had reached popping-off point. The riding proved very good, "No. 5925" being in excellent shape, and taking the frequent curvature well. The speed was higher than I had noticed on previous trips over this division going west. Flegal evidently meant to recover those 13 superfluous minutes as soon as possible, and did so to the extent of six of them by the time Cochrane and a water stop was made; 23 miles in 31 min., 44½ m.p.h., during which the train had been lifted 300ft., with 1100 tons; quite good. One could feel the engine was being extended a little; the speed was mostly around 55, and called for occasional checking on curves. It was pleasant in that clean, cool cab—such a contrast to the dusty coal burners of the previous few days, with their grit and grime. Goggles were not necessary, nor even overalls. It appears from my notes that enthusiasm increased under the influence of the fine day and good-riding engine. "Takes curvature extraordinarily well, in spite of long wheel base"—that is, 46ft. for the engine and 22ft. for the coupled wheels. Flange lubrication for the first pair of drivers and a lateral cushioning device giving ½in. side play each side of the centre line help considerably on curves. This arrangement is shown in Fig. 8, which is practically self-explanatory. The lateral motion is controlled by the coil springs in front of and behind the axle. The device is a product of the American Locomotive Company. In addition to these easements, the track is spread on curves to the extent detailed in No. II, with the result that these large and lengthy engines negotiate curves with far less objection than one would anticipate. Of course, they do kick a little—it is only natural. Some such arrangement as this might have been found useful on the L.N.E.R. "P 2s" working on the sinuous Edinburgh and Dundee route, over which I made my runs with "Mons Meg" (The Engineer, October 6th, 1939). On that occasion I was pleasantly surprised at the easy way the long wheel-based engine took the many curves, as my first sight of a member of the class had led me to expect less tractability. I had found "Earl Marischal" off the metals, leaning wearily over at an

angle among a maze of points and sidings at King's Cross, thus registering objection to being forced round a bend too acute for it. It is strange how devices that attain considerable popularity on locomotives in one part of the world fail to do so in another, for no apparent reason. The Krauss-Hemholtz leading truck arrangement, for instance, in which the front axle is combined with the leading coupled axle to form practically a four-wheel bogie. It has been used quite extensively on the Continent, yet has been ignored in Britain and North America, in spite of many long-based engines having been built in both countries—though principally in America—which might have benefited from it.

West of Cochrane, the rolling foothills begin to take on quite a South Downs aspect, and an isolated clump of trees brought Chanctonbury Ring into my mind—and a pang of homesickness. Curvature became more frequent and acute, but "No. 5925" took it as it came, unconcernedly, and with speed in the 50s there was none of that deck vibration in time with the throw of the coupling-rods I had noticed on the same class of engine going east. She was quite the best "5900" engine I had ridden. The second stop was at Morley, where the Bow River has been dammed into a great sheet of water to provide Calgary with light and power. The Rockies came into clear view, blue-grey, and slightly hazy in the heat of a perfect summer day. We were only 2 min. late now, the 19 miles from Cochrane, plus a rise of 328ft., having taken 27 min. start-to-stop, 42 m.p.h. The gradient profile given in No. II may be referred to, and from it a steady climb will be recognised. The country was getting more treed with birch and fir, and was losing most of its nakedness. This was the eastern side of the mountains, and dry, with little greenery, either of tree or grass. A stop was made at Kananaskis to put off supplies for an internment camp. I suppose even Germans must be regarded as theoretically human, and fed; the environment seems too good for them, in my opinion. Then came Exshaw, with a big cement works, where they have been whittling away at the limestone rock for many years without making any perceptible impression on the mountain mass. "The Gap," the narrow entrance to the Rockies. We were well up here, though still in close proximity to the Bow River and the motor road, along which mountain goats were hiking as to the manner born, paying no attention whatever to the train. The line now began to run through fir woods, with bare rocks towering in the background, without any snow showing on them—it was the wrong time of year, and they were not the giants with crests white the year round, which come farther along. The air began to take on its cool, delicious mountain tang, doubly refreshing after the prairie dust and heat. We were over 4000ft. up and still climbing. At Canmore the gorge widens out into a valley, where there are coal mines. The gradient eases off for a while, straights become longer, and the speed rose higher, nearer 60 than 50 at times. But closing Banff the pull begins again, past a "Dude Ranch" where children of both sexes and all ages play at being cow hands, acting "wild and woolly," a buffalo corral, a beaver dam, to a stand in the station at 11.10 O.T.; 1000ft. had been climbed in the 82 miles from Calgary, and an elevation of 4534ft. reached in 147 min., an average of 33·5 m.p.h., including six stops.

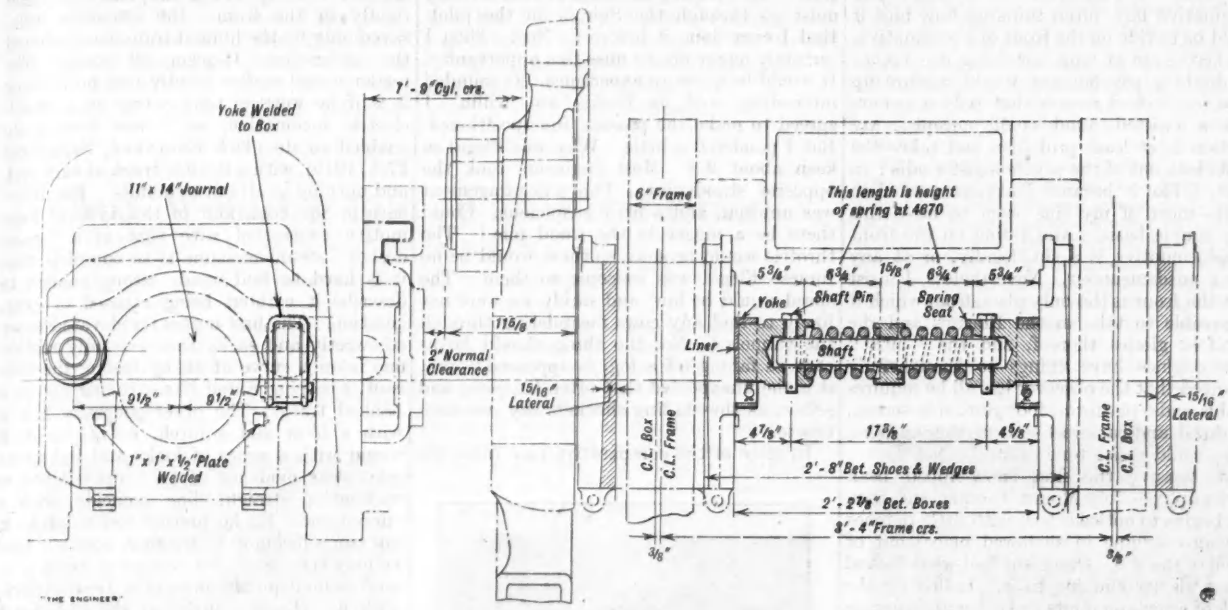


FIG. 8—LATERAL CUSHIONING DEVICE ON DRIVERS

FIG. 9—KICKING HORSE CANYON

At Banff the scenery becomes too fine to justify missing any of it by remaining cooped up in the cab, so I transferred myself to that favourite vantage point, the steps leading from the front platform up alongside the smoke-box. I not only wanted to see all there was to be seen—which is a good deal in the Rockies—but also to study the reaction of a lengthy engine to frequent and sharp curvature. I had done plenty of this from the cab—now the other end would receive attention. I felt it was necessary to see what was coming, and also what was underneath, before forming conclusions, and the front end was the best place to use as a judgment seat. So there I took up my vigil, in splendid isolation, save for the company of the battered corpses of countless grasshoppers that had rashly challenged "No. 5925's" passage, but put on the spot, bumped off, and taken for a ride. It was pleasant sitting there, with the sun shining across the milky waters of the Bow River, the warm breeze rustling in my ears, and blending with the

subdued murmur from the smoke-box, and the muffled rumble of the wheels. It was both soothing and satisfying, and—confession being good for the soul—there came to me the explanation of why I found it so enjoyable. I remember, as a small and imaginative boy, often thinking how nice it would be to ride on the front of a locomotive, and here I am at long last doing it. *Voila!* No doubt a psychologist would conjure up some far-fetched reason that only a person with a twisted mind could accept; my solution is at least probable, and takes the wind clean out of the psychologist's sails; in short, I like it because I always wanted to do it—most of my sins seem to have this very simple basis. And riding on the front of a locomotive is a sin, legally, or at any rate a misdemeanour. Nevertheless, I insist that the front is the only place from which it is possible to take in the Rockies and the manifold glories thereof, and the "5920" class engines have things so thoughtfully arranged that the observer has all he requires to this end—platform, foot rest, side screen, hand rail, and back rest—all are there. Who, then, could resist temptation? Not I.

At Massive the first snow-tipped peak looms up, possibly Mount Temple, and then one begins to notice others with little patches of white lodging in sheltered places out of reach of the sun. One giant had what looked like a glacier clinging to it. Lulled by the click of wheels on joints and other appropriate rhythmic sounds, the track peeled away underneath. For some distance it had been almost level, and the engine had done little more than drift, but nearing Castle Mountain thunder suddenly broke out overhead—the throttle had been opened, and the speed steadily increased to 50 or more as "The Dominion" began to spin along the succeeding straight, and the rush of the wind strengthened to a gale as it poured past. The thunder ceases, the throttle shuts, and vacuum valves begin to sniff as the engine drifts down a straight where welding had been and was being carried out (Fig. 10). When I had passed over a similar stretch of welded track east of Winnipeg, I had been in the cab and was able to detect little difference between welded and unwelded track, so far as the engine's behaviour was concerned, but now I was at the front end, ready to take accurate notes of whatever might befall; but no, the verdict was the same. The running was somewhat quieter, perhaps, and clicking less obvious, but there seemed practically no difference in the riding, apart from the effect of imagination. It had been good before, and remained so. Nearing Lake Louise, with the Bow River almost lapping the embankment, "No. 5925" again speeded up, taking one or two bends at 50 or as near as no matter. It felt a little curious; rather like being on a merry-go-round at maximum revolutions, swinging out high above the heads of the crowd! Sitting on the outside edge right at the front, when the pilot took up a position more or less tangential to the curve, it seemed swinging clear of the track altogether, and I far out in space, right over the water of the Bow! It looked as if the engine must be half off the track, and that any moment might find me *in medias res*—that is, *in medias* of the Bow River. The engine was not taking the bends in a smooth sweep either, but more in a series of rhythmic lurches, slightly disturbing, arousing conjecture, and a trace of apprehension. "No. 5925" did not seem to like it altogether! But, of course, nothing happened—coming events did not cast their shadows before, and all the flanges remained where they were intended to, inside the metals. I have been gravely chided once or twice on my criminal penchant for pilot riding, and have cried *mea culpa*, but neither the chidings nor the acknowledgment of guilt ever seems to have a lasting effect. Curiously enough, I noticed that Flegal did not chide me—on the contrary. He was almost insistent that I really must go through the Spirals on the pilot. Had I ever done it before? No? Then I certainly ought not to miss this opportunity. It would be quite an experience. It sounded interesting, and as Barkis was willin', I agreed to make the passage thus positioned. But I pondered a little. Why was Flegal so keen about it? Most engineers took the opposite standpoint. This encouragement was unusual, and a little suspicious. Could there be a nigger in the wood pile? The throttle would be shut, so there would be no fumes—Flegal was welcome to them. The speed would be low, and surely we were not likely to find any cows meandering through the tunnels? No, the thing should be as easy as falling off a log, it appeared; alas, it is the unexpected that often happens, and—but, as the shilling shockers say, we anticipate.

In spite of the comparative ease (note the

FIG. 10—WELDED TRACK

adjective) with which "No. 5925" took curves, it was impossible to keep from thinking, as I so often have, particularly since riding Garratts and diesel-electrics, of the uncouthness of the "basic design" locomotive, of its uncompromising rigidity. Small, short-based engines adapt themselves to curvature well enough, no doubt, without too much objection on the part of either locomotive or track, but how can a vehicle with wheels strung along a base of 46ft., the middle ones being allowed no side play—that is the vital factor—be expected to adjust itself properly to a curved support? Theoretically it is impossible, and mechanically it is crude; it cannot be done without heavy wear and tear, and the racking of both engine and track. A parallel instance, often a good way to emphasise a point—a twelve-wheel 70ft. passenger coach takes a curve without serious objection, because the wheels are grouped only at the ends, leaving the middle part of the vehicle free to assume a position as the chord of a segment, with the ends tangential to the curve, but what would be the coach's behaviour if the six axles were equi-distant along the frame, with only the end ones free to move sideways? Its action would be quite spoilt, and instead of taking bends smoothly, with little friction or shock, it would jerk, rack, and twist, and have to be forced round. Just the same with a long-based locomotive. The axles that theoretically should be allowed side play—or, better still, should not be there at all—the drivers, midway along the base, are held rigidly in the frame, the situation being saved only by the limited translation allowed the extremities. It seems all wrong! The reader would realise vividly just how wrong it is if he were to take a trip on a diesel-electric locomotive, as I was fortunately enabled to do (THE ENGINEER, September 27th, 1940), with a flexible truck at each end, and nothing at all in the middle. The difference in the behaviour of this type of locomotive contrasted with that of a "basic design" steam machine is so complete that it is hard to find words strong enough to describe it without being accused of exaggeration. The first enters an elevated curve so sweetly and easily that one only realises one is on a curve at all by feeling the floor cant, sweeping round like a racing car on a banked track. The other generally hits it with a blow and a lurch, wrenching itself round with a series of kicks and jerks that give clear evidence of the impossibility of making a straight line coincide with a curved one. Euclid himself could not do it, nor can a locomotive designer, however hard he may try. Shall we ever see a steam locomotive built on the lines of a diesel-electric, with its wheels grouped at the ends, each driving axle independently gear-driven by a high-speed enclosed engine? Surely this is possible, and not fantastic? It would have many advantages. The boiler would no longer be cribbed, cabined, and confined by frame and wheels, but free to assume any shape desired; no hammer blow, no coupling-rods; an engine no longer "like a laddie runnin' wi' his breeks doon," as Patrick Stirling put it, but easy riding and adaptable, kind to itself and the track. A dream perhaps, but a pleasant one! No matter how much the arrogance of an eight-axled engine may be deferred to by flange lubrication, lateral cushioning, and gauge widening, the fact that these things have to be done at all points a moral—it is unkind to force a curve and a straight line into coincidence. Both will object, and be unhappy in double harness. Summing up, may I be allowed to quote my own words, penned while still stirred by the revelation of diesel-electric riding perfection? "Comparisons are odious, perhaps, but inevitable when one makes one's first run on a diesel after thousands of miles on steam locomotives. I thought of the latter, hammering and pounding along the rails, even when in the best of condition; often nosing and lurching around curves, hitting them with a blow and a wrench that spell wear and tear in both engine and permanent way—and then of 'The 400,' spinning smoothly along, snaking round curves with easy flexibility, silent, sinuous, smokeless. . . . Impossible to avoid thinking: 'Surely this must be the writing on the wall—the long day of the steam locomotive of basic design seems drawing to a close.' It will be noticed that I have qualified the query, 'the steam locomotive *of basic design*.' High-speed, multiple-unit, gear-driven machines, perhaps they have a longer future, but the present basic type—I wonder." That was written two years ago, and as I sat on the front platform of "No. 5925," watching the track curve and straighten in front, feeling the engine's reactions, I thought of that "400" run, and was not inclined to retract what I had penned two years before. The future will tell whether or not I was a true prophet.

The gradient stiffens again after Lake

Louise, and the last climb to the summit begins. The speed fell to little more than 10 m.p.h., the exhaust sounding deliberate, determined. The cow-catcher was certainly superfluous here—there would have been almost time to get down and shoo the animal off the track. When at last "The Great Divide" was reached "The Dominion" had attained the highest point on the line between the Atlantic and the Pacific, 5337ft., and there, beside the track, was the little stream that has been trained to send half its water into the Pacific, *viâ* the Kicking Horse and Columbia rivers, and half to the Atlantic, following the Bow and Saskatchewan to Hudson Bay. The train stops a few minutes by the arch spanning the imaginary line, the boundary between Saskatchewan and Alberta, which also marks the Divide, to give passengers an opportunity of taking in all these features.

(To be continued)

Arc Welding and War Production

By E. C. DAVIES, A.M.I.E.E.*

No. II—*(Continued from page 257, September 25th)*

FIG. 5 shows the result of a bend test on a high-speed butt weld taken in accordance with British Standard Specification 709—1940. Izod impact values of the order of 50 foot-pounds are obtainable from samples butt welded by high-speed welding. Where high impact resistance is a necessary requirement, it is usually desirable to deposit a further light run over the second in order to obtain a more uniform grain structure throughout the full section of the weld.

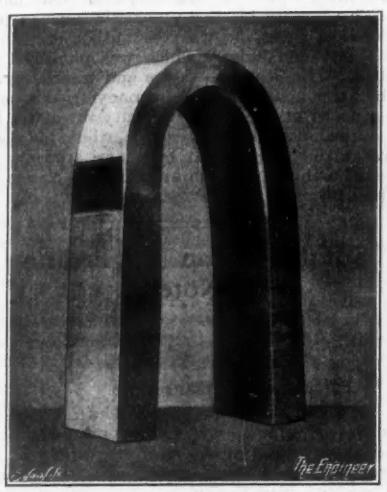


FIG. 5—BEND TEST ROUND 1-INCH MANDREL

The T weld shown in Fig. 6 is another example of the degree of penetration which is possible with this technique. The two ⅜in. plates were close connected without chamfering and were welded with a single fillet on each side. Complete fusion has been secured and an adequate throat thickness provided with a minimum amount of deposited metal. The alternative method would have necessitated double chamfering with three or four runs on each side, which would not only have taken several times as long to complete, but which would have consumed at least twice as much electrode material for a given operation.

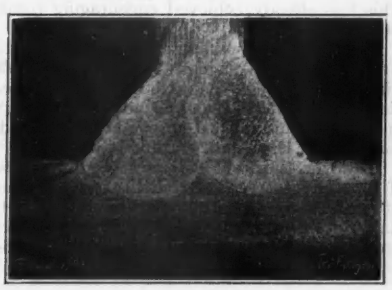


FIG. 6—"T" WELD IN ⅜-INCH MILD STEEL PLATE

It is necessary to emphasise the use which can be made of the penetrating characteristics of the high-speed arc in eliminating the necessity for chamfering and other forms of plate preparation. In these days gas-cutting plant is generally utilised to its maximum capacity, and any increase in fabrication by welding will necessarily throw an extra load on to it. Any relief which can be obtained by eliminating work which otherwise would have to be carried out by this means must be regarded therefore as of primary importance. This should be borne in mind when comparing high-speed welding with other methods involving additional plate cutting.

The Case for Manipulation.—Since the pool of metal produced during high-speed welding is considerably larger than that involved in multi-run welding, it will be realised that this would be difficult or impossible to control if the work were inclined at any appreciable angle. This implies that, in order to take full advantage of high-speed welding technique, all connections should as far as is practicable be completed in the horizontal downhand position.

With small fabrications, this is usually achieved without difficulty, but larger components naturally present certain problems in handling. Some reluctance existed, particularly in this country, to the adoption of a technique which involved a considerable amount of manipulation of large units, and this was one reason for the somewhat slow progress made by the process in Great Britain until comparatively recently.

In the United States, however, and within the last few years in this country also, manufacturers have recognised that the advantages offered by downhand welding are great enough to justify the expense of installing plant to manipulate components being fabricated, in order to allow all welding to be performed at the maximum speed.

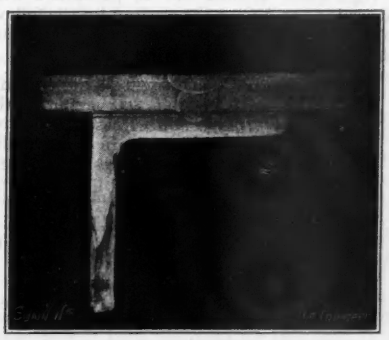


FIG. 7—BUTT WELD

These manipulators are often quite simple, inexpensive pieces of apparatus, though nonetheless effective, but for larger work may be massive motor-driven constructions, capable of handling hundreds of tons of steel work. Several well-known British firms now manufacture this equipment, and an increasing number of the medium-sized units are being employed throughout the country. Figs. 8 and 9 illustrate one such unit having a capacity of 1 ton.

In an American shipyard the increased speed

FIG. 8—1-TON MOTOR DRIVEN MANIPULATOR

FIG. 9—WELDING TRANSFORMER CLAMP PLATE ON MANIPULATOR

* Design Department, The General Electric Company, Ltd., Magnet House, Kingsway, London, W.C.2.

obtainable from downhand welding made the manipulation of the whole ship's framework a justifiable undertaking. As previously stated, however, expert direction in the design stage can do much to eliminate positional welding, and to reduce the amount of manipulation required.

Fig. 7 indicates a type of butt weld suitable in the shipyard for deck plating and tank tops, which by employing an appropriate bearer to act as a butt strap enables the weld to be completed from above. The plates shown are ⅝in. thick and are welded without pre-chamfering in two runs, the first of which will be seen to have penetrated deeply into the bearer.

The high-speed welding referred to in the preceding notes is performed manually with currents up to 600 amperes or a little more. This has been found in practice to be somewhere near the limit for hand operation. Correspondingly higher speeds are, however, obtainable with automatic plant, and in suitable circumstances welds may be made by this method, using currents of the order of 2000 amperes.

Plant for Manual High-speed Welding

High-speed welding can be performed with either D.C. or A.C. at the arc, but for the following reasons where new installations are contemplated A.C. is generally to be prefered :—

(1) With the tendency to use currents appreciably in excess of 300 amperes, the magnetic or "blow" effect associated with the D.C. arc tends to make arc control difficult, particularly near plate edges and changes of plate section.

(2) The installation cost of A.C. plant is less than that of the equivalent D.C. plant.

(3) The running cost of A.C. plant may be only half that of similar D.C. plant.

(4) A.C. welding plant, being static, is more robust and requires negligible maintenance.

When completely portable engine-driven plant is required, however, D.C. sets are usually more practicable, as is also the case when only D.C. mains supply is available.

When A.C. plant is contemplated for high-speed welding, some care is necessary to ensure that suitable characteristics are obtainable. The transformer secondary voltage should be considerably higher than that used for multi-run welding in order to maintain the stability of the arc during deep penetration.

It is well known that the stability of an A.C. arc varies inversely with the power factor of the supply to it. As the arc lengthens during increasing penetration, the arc voltage which is in phase with the current increases and the power factor of the circuit, including transformer and stabilising reactance unit, rises and brings the transformer secondary voltage in closer phase relationship to the arc current, with consequent loss of stability.

In order to maintain steady arc conditions during deep penetration with currents of 500 to 600 amperes and arc voltages of 40 to 45 volts, it is sometimes advisable to use transformer secondary voltages up to 110 volts instead of the more usual value of 75 to 85 volts. The actual value required is, however, dependent on the type of electrode used and the degree of penetration necessary.

In order to eliminate interference between welders, single-operator plant is to be recommended wherever practicable, and in these cases sets of 300-ampere capacity normally prove to be satisfactory, being used singly or in parallel to suit the work undertaken. For shipyard and similar installations, however, multiple-operator transformers with external current-regulating reactors are advisable in order to simplify cabling problems, and in these circumstances precautions must be taken to reduce the impedance of the welding supply cables to the lowest practicable value to minimise interference.

The selection of the correct type of welding plant for a given duty should be a matter for careful consideration, and here, again, expert guidance should be sought from specialists.

It is also urged that unsuitable existing plant should be replaced in the interests of production efficiency by equipment designed to provide the characteristics necessary to achieve maximum welding speeds.

Conclusions

It is suggested that in view of recent developments in connection with electrodes and arc welding plant which have been responsible for the results achieved by high-speed deep-penetration welding technique, engineers would be well advised to acquant themselves with these improved welding methods, the adoption of which would, in many instances, result in very material benefits, such as increased rate of production, savings in labour and material, reduction in cost, &c.

Where riveting or casting processes have been previously justified on the basis of comparison with fabrication by multiple-run arc welding, it would now be advisable to reconsider existing policy, taking into account the increased welding speeds obtainable by the use of the improved methods now available.

Some emphasis has been placed on the advantages accruing from the adoption of high-speed welding which involve manipulation of the work, but where this is found to be impracticable, positional welding with modern plant and electrodes may result in valuable economies compared with riveting.

Another aspect which should be borne in mind is the possibility of introducing fabrication by welding as a supplement to present output which is being attained by other methods. This has already achieved encouraging results in certain shipyards.

It has not been possible in the foregoing notes to do more than suggest briefly some of the directions in which the introduction of fabrication by arc welding, or the adoption of high-speed technique in place of less efficient methods, might assist the country's productive effort.

However, they will have served their purpose if they have succeeded in indicating the trend of modern arc welding practice and thereby have been of some assistance to engineers confronted with wartime problems of construction.

Obituary

PROFESSOR P. A. HILLHOUSE

It is with deep regret that we have to record the sudden death, at his home, "Whitworth," Busby, near Glasgow, on Monday, September 28th, of Professor Percy A. Hillhouse, whose retirement from the John Elder Chair of Naval Architecture at the University of Glasgow was only announced a short time ago. Professor Hillhouse underwent a serious operation at the end of last year, from which he recovered; but he had not been too well for some time past, and his death took place following a seizure. He was born at Derby on March 4th, 1869, and was the son of the late Archibald Hillhouse, who was the general goods manager of the Caledonian Railway Company in Glasgow. He was educated at the Partick Academy and the Albert Academy, and passed to the University of Glasgow, where he studied under the late Lord Kelvin. He had an outstanding academic career and was a prizeman in naval architecture, natural philosophy, and mathematics. After graduating as B.Sc. in 1888 he became a draughtsman at the Pointhouse Yard of A. and J. Inglis, shipbuilders and engineers, and remained with the firm until 1893, when he entered the drawing-office at the Clydebank Shipyard, now John Brown and Co., Ltd. In 1898 he accepted the appointment of Professor of Naval Architecture at the Tokyo Imperial University in Japan, a position which he continued to hold with distinction until 1902. During the time he was in Japan, Professor Hillhouse was responsible for the design of a number of ships, many of which came into prominence during the Russo-Japanese War.

In 1902 Professor Hillhouse returned to Scotland and was appointed assistant to the late Dr. Francis Elder, who was at that time chief naval architect with the Fairfield Shipbuilding and Engineering Company, Ltd. On the death of Dr. Elder, one of the most famous of Scottish shipbuilders, in 1909, Professor Hillhouse succeeded him as chief naval architect, and was at the Fairfield yard at Govan during its notable period of expansion under the late Sir Alexander Gracie. He was directly responsible for the design and construction of many famous naval and mercantile vessels, including submarines. In the middle of the last war, in 1917, he nearly lost his life in the Gareloch trials of the steam submarine "K13," when, along with fourteen Fairfield officials, he was carrying out official trials of the submarine. It will be recalled that after one successful dive the "K13" failed to surface, and Professor Hillhouse was one of the forty-seven men who were finally rescued from the sunken submarine, after several days of rescue operations. During the last war Professor Hillhouse served on many Government Committees, and he continued his work at the Fairfield yard until 1921, when he was appointed to the John Elder Chair of Naval Architecture in the University of Glasgow, as successor to the late Sir John Biles. Apart from his university work, which was outstanding, Professor Hillhouse found time to write for many of our scientific institutions and technical societies. He was a Vice-President of the Institution of Naval Architects from 1928, and was President of the Institution of Engineers and Shipbuilders in Scotland from 1935 until 1937. Besides his many contributions to the technical Press, he was the author of "Ship Stability and Trim," which was published in 1918. His deep knowledge and his charm of character endeared him to many friends, and his death at the age of seventy-three will be mourned, notably on Clydeside, where his work was mainly done, and by many students of naval architecture who attended his classes at the University of Glasgow.

South African Engineering Notes

(By our South African Correspondent)

Cape Town.

(Delayed in Transmission)

Parachutes and Blankets

The war has given South Africa an industrial impetus it would not otherwise have received in 100 years, and the variety of its wartime production continues to expand. Parachute cord is now being manufactured at Cape Town at half the imported cost, and the Union's armoured cars form one of its greatest contributions to the war effort—only the other day an order was received for 2000 more. Millions of blankets are being made in South African factories, of local wool. Boot uppers are no longer imported and an order for 4½ million pairs of the Union's famous Army boot has recently been placed. When no more rock containing an ingredient essential for steel production could be imported from Morocco, investigation resulted in the discovery of deposits of the same kind near Saldanha Bay, in the western province of the Cape. When certain acids are removed from this rock the residue, it has been found, is valuable as a fertiliser.

Drying the Union's Produce

Meat, milk, fruit, and vegetables are now being processed in several "drying" plants in the Union, but so great is the present demand for all kinds of farming produce in this country that none can as yet be exported. The erection of a large drying plant, able to absorb vast quantities of fruit and vegetables and so eliminate gluts, has been suggested to the authorities. It is urged that if such a plant were erected there would be no need for fruit and vegetables to be wasted or thrown on the market at prices unprofitable to farmers. The objection to this scheme, it is stated, is that a large plant could not be allowed to remain idle at intervals. Gluts occur irregularly, and in times such as the present most crops are quickly absorbed and the quantities available for processing are uncertain. It is argued, however, that this position could be met by encouraging production on a large scale. Raw material for the plant would then be abundant and what was not needed by the Union could be exported. Reserves of concentrated dried foods could

also be built up in times of abundance and used when necessary—for instance, in time of drought or to feed the native population. Vast quantities of food will be required for the starving millions in Europe after the war. Sent in concentrated form, the food would occupy less cargo space and could be easily handled. It will be required for years to come to increase and improve the diet of people all over the world.

Boring for Oil in S.A.

Colonel C. F. Stallard, Minister of Mines, has recently stated that the Union Government intends to bore for oil in the near future. He emphasised that there was a possibility only of striking gusher oil. Difficulty was experienced in obtaining equipment, but it was hoped that it would be possible to make a start at boring soon. He declined to say where the boring would take place, because information of this nature might lead to speculation. Efforts are also being made, he stated, to increase the output of the coal mines, which are working at top pressure. Chrome, manganese, asbestos, and iron ore are other leading factors in the Union's mineral development. Colonel Stallard referred to the prospects of producing tungsten and believed they were favourable.

Tungsten

The key position of tungsten among metals has been forcefully and emphatically brought to the attention of those entrusted with the defence plans of the Allied countries. The increasingly urgent demand for more ships, more aeroplanes, and more tanks has made it very clear that only with the best and fastest working tools can industry be expected to meet absolute needs, and tools made of tungsten steels are unrivalled in their performance—minutes are now sufficient to do the work that once took hours with the old carbon steel tools. The demand for tungsten ores exceeds all previous records, and the enhanced price has stimulated search throughout the world and a number of important discoveries have been made. In South Africa the limited production of Southern Rhodesia has been dropping somewhat lately, but it is expected that the increased prospecting now proceeding will have good results. Old Transvaal mines, like those of the Mutue Fides-Stavoren tinfields, Merchison Crown and Stromboli, where the presence of the ore has been known for a long time, have not yet received attention, but are to do so now. Along the banks of the Orange River, *i.e.*, in the Gordonia, Kenhardt, and the Namaqualand districts, and in South-West Africa, the latest activity is showing good results. In the Union this field is the most extensive and the ore occurs consistently. A pleasing feature is that a start is being made towards the proper development of tungsten ores under adequate capital control. At present South-West Africa produces quarterly only about 20 short tons, estimated to contain approximately 69 per cent. WO_3; but a considerable spurt is expected. Wolfram (tungsten) occurs in the Union combined in the two minerals wolframite and scheelite. The first is a tungstate of iron and manganese, the second is tungstate of lime. Up to the end of 1934 tungsten ore to the value of £6149 had been exported from the Union, but most of it was in the form of concentrates containing tungsten for which the exporters were credited overseas. Consequently no more detailed tungsten returns are available. In the Mutue Fides-Stavoren tinfields scheelite is, after cassiterite, the most important ore mineral. During the last war 30 tons were recovered, but owing to the big drop in price after the war the recovery was abandoned. It will now be resumed. In the Merchison Range scheelite occurs associated with tin. Eluvial wolframite is known near Leydsdorp. It is also found south of Barberton, and there are valuable amounts of tungsten west of Potgietersrust and in the Rooiberg. Wolframite is known near Melmoth, Natal. At Kenhardt, Gordonia, and Namaqualand there are numerous small deposits found in the quartz pegmatites and many are now being prospected. Nearly all known occurrences in the Union are now being prospected, many for the first time, while none have had the serious attention now being, or about to be, devoted to them, and it is considered to be almost certain that new and valuable finds will result.

Road Surfacing

Unless South Africa can produce enough tar of a suitable type for covering the surface of roads new roads will not be bituminised, according to statements made by the Acting Engineer of the Cape Divisional Council. He said that it was almost impossible to obtain asphalt—which has to be imported—even for the maintenance of existing roads, and there is none available for surfacing new roads. This does not mean that the construction of new roads will come to a stop, for the roads can be constructed and need not necessarily be bituminised. The Divisional Council has successfully used tar produced in Cape Town for the lower coat of road surfaces, using asphalt for the top coat. It has not yet tried tar for both coats. In the Transvaal, however, complete surfacing experiments have been carried out with South African tar, produced there. The results of these experiments are believed to have been successful. Should tar be a successful substitute for asphalt as a top coat for road surfaces, its use will naturally depend upon the quantity which can be produced in the Union.

Water Scheme Delayed

Owing to the impossibility of obtaining steel water pipes from anywhere abroad, a public meeting at Port Alfred has authorised the Town Council to use for the town's water scheme water pipes made in South Africa. The inability to obtain overseas supplies was explained as being due to shipping for the imported pipes on order being unobtainable.

Irrigation Scheme

Details of a large irrigation scheme by which 3000 farms in the Vet and Sand rivers districts would benefit were given recently by the Minister of Lands and Irrigation. The Minister said the Government was considering a scheme to divert the water of the Caledon River into another valley and lead it for 21 miles through hill tunnels to two dams on the Vet and Sand rivers, from which 50,000 to 60,000 morgen would be brought under water. The building of the dams will not be started till after the war. The Minister said that the Government was opposed to land speculation, which frequently occurred when irrigation schemes were under consideration.

The Canadian-Alaskan Highway

ON Thursday, September 24th, it was officially announced by Mr. Henry Stimson, the United States Secretary of War, that the 1600-mile-long Canadian-Alaskan Highway, now known as the Alcan Highway, will be opened for traffic on Tuesday, December 1st, several months earlier than the date originally scheduled for its completion. The road runs from Dawson Creek, in British Columbia, to Fairbanks, Alaska, by way of White Horse, in the Yukon Territory. It has been surveyed and constructed by the United States Army engineers under the command of Major-General Eugene Reybold, the chief engineer officer. The work was started last March, when the agreement for its building was signed by the Canadian and United States Governments. Extremes of climate have been met with during its construction. Temperatures varied from as low as 35 deg. below zero to 90 deg. in the shade, when gloves and head nets had to be worn as a protection against clouds of mosquitoes and biting flies. What was first planned as a rough pioneer road has now been completed for much of its 1600-mile length as a well-graded, well-drained highway, which, on many stretches, will accommodate two-way traffic. About half the length of the new road has been metalled, but during the next two months that operation will be completed, ready for handing over the new highway to the Public Roads Administration of the United States. While the road will be impassable during the April thaw, it will enable the United States Army to send supplies by road for four months to the highly important airfields in the interior of Alaska, which so far have been almost entirely dependent on supplies sent by air. Next year the utility of the Alcan Highway will be increased, especially if it is extended to the shores of Bering Strait. As Alaska is only some 100 miles from Siberia, the new highway may prove to be the first step towards providing, not only air bases, but also land bases for assisting Russia and attacking Japan. It will certainly relieve the shipping of supplies from America to Alaska, which has recently been threatened by the Japanese invasion of some parts of the Aleutian Islands. Alaska is known to possess considerable mineral wealth, which after the war will find an outlet by the road to Canada and the United States.

International Trade After the War

AT a meeting of the Institute of Transport, which took place on Thursday, September 24th, under the chairmanship of the President, Sir Patrick Hannon, an interesting address on international trade after the war, as seen from the Czechoslovak point of view, was given by Dr. George Lewi, Deputy Chairman of the Association of Czechoslovak Scientists and Technicians. After describing the social planning and industrial organisation of the Czechoslovakian Republic, Dr. Lewi commented on the German penetration into East and South-East Europe, and said that it was difficult to understand the lack of interest of both Great Britain and the United States in these European markets. In considering post-war international trade, it was very necessary to take into consideration the background which was responsible for two great world wars, and the crisis between them. Even during the war, however, we could come to certain conclusions, which might be expressed in workable agreements between the United Nations, which could be put into practice the very first day after the war. Such a scheme should be capable of being adapted to any anticipated political form, and everything possible should be done to prepare for immediate post-war relief. Air traffic would play its own part, and air routes might be considered and settled upon. Post-war international trade would require immediately appropriate international agreements relating to unified Customs tariffs and the standardisation of currency and exchange. There should be equal access to mineral and other resources, as clearly defined in the Atlantic Charter and the recent International Conference of the British Association. Some practical solution was needed. We had in London representatives of all the treasuries and governmental banks of the allied nations, with their tremendous knowledge of the complicated pre-war conditions. They could, Dr. Lewi suggested, together work out a scheme which would create a sure foundation for good economic relations. There must be a just settlement of labour problems, and one of the best ways of reviving international trade was to raise the standard of life. Quite obviously, Dr. Lewi concluded, the whole problem of the future of international trade, and indeed the whole standard of our life, would depend primarily on the internal strength of the victors.

FUEL OILS FROM COAL.—The U.S. Bureau of Mines is to investigate methods for producing liquid motor fuels and lubricants from coal by the Fischer-Tropsch process, and an experimental plant is to be erected at Pittsburgh. The immediate aim of the investigations is to provide economical and easily built units for U.S. military outposts, and for this purpose the advantages of the Fischer-Tropsch process are considered outstanding. Authorisation has also been granted to the Bureau to spend half a million dollars on a laboratory, where the recovery and processing of minerals from the Pacific North-West, with electrical energy from the Bonneville and Grand Coulée dams, is to be studied.

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CHANGES OF ADDRESS

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HIGH-ALTITUDE FLYING

CONSIDERABLE as are the effects on airframe and engine of the decrease of air density at altitude, the consequences on the human body are even more striking. At a height of 50,000ft. the air density has but a ninth of its sea-level value—little removed from the completely vacuous—and at any given speed this reduces the lift of the wings in the same drastic proportion; were it not for its superchargers engine power would fall similarly. Impressive as this is, the way to meet these mechanical difficulties is now well known and is seen in the steadily rising ceiling attainable by modern aircraft. The physiological effects on the human body are in a different category, but are even more impressive, since it is necessary to take care of airmen, not only when they are seated in the aircaft, but when, forced to bail out, they begin to fall to the earth before the parachute has opened as well as afterwards.

Since the air pressure at 35,000ft. is only about one-fifth of its sea-level value and since the proportion of oxygen present in the atmosphere is also one-fifth, it follows that human beings should be about as well off when provided with pure oxygen at 35,000ft. as in normal breathing at sea level. Experience in flight, however—as in the low-pressure chambers used in experimental laboratories—has shown that even without extra oxygen the adaptability of the human body is such that an altitude of 15,000ft. can be borne. This slight degree of oxygen starvation the lungs can overcome, provided that no great physical exertion is being made at the time. It can be computed that supplying pure oxygen instead of air should enable flight to be made at 42,000ft. with just the same degree of endurable starvation; but experience in the low-pressure chambers shows that at 45,000ft. the fainting point of the human body is closely approached, corresponding to the condition which would arise in the absence of any special oxygen supply at 20,000ft. These heights are found to agree closely with the altitude records obtained in flight in past years with pilots supplied with oxygen masks. A height of 44,000ft. was attained in 1932 and 47,000ft. in 1934. It was only through the subsequent use of a pressure suit—a kind of diver's suit—that the height record was carried to the present figure of 56,000ft. With such a suit, or with its equivalent in the form of an enclosed pressure cabin, the physiological limit to height is removed once for all and the task of beating the record is thrown on the mechanism of the aeroplane itself, principally, of course, on the engine. There the limit, no longer a physiological one, is reached when the increasing weight of superchargers overbalances the gain in power due to their use. When a high-flying aircraft is abandoned a falling airman, not provided with any special oxygen supply, would have perforce to rely on such oxygen as he could breathe in the attenuated atmosphere, and at great heights this would not be enough. The terminal velocity of a freely falling human body is about 170ft. per second, but when the parachute opens this falls to between 40ft. and 20ft. per second (depending on the type of parachute and the height). Since man's physical endurance when breathing in such atmosphere as exists at 30,000ft. and over is limited to a few minutes, it is important that he should reach the comparative safety of the 18,000ft. level as rapidly as possible. Hence the opening of the parachute needs to be delayed to enable advantage to be taken of the high speed of the free fall to the level at which the parachute can be allowed safely to open. It has been estimated that if an airman leaves his aircraft at 35,000ft. and opens his parachute at once it will take him about ten minutes to reach 20,000ft.; this is far too long for safety, whereas if he delays the parachute opening for one and a-half minutes he will reach the safe level for ordinary breathing. The taking of such a precaution requires continual alertness, and needs it just at a time when semi-consciousness caused by lack of oxygen is likely to be near at hand. It is for this reason that small portable oxygen sets have been introduced to enable airmen to be assisted during the critical fall from dangerous heights to the relative safety of the 18,000ft. level.

The very rapid rate of climb of modern aircraft also produces its own problems. The new German "F.W. 190," for example, is found to have a rate of climb of over 3000ft. per minute for the first 15,000ft. or so. This puts the airman under the same sort of stress as an ascending sea diver, who, as is well known, must only be allowed to "decompress" at a certain rate; otherwise the nitrogen dissolved in the blood and tissue fluid will bubble out and so form "air locks" dangerous to life. But this problem fortunately is less severe in the air than it is in the sea, since 1000ft. of air are only about as effective in pressure change as 1ft. of water. Nevertheless, it is a phenomenon which has to be carefully watched, especially as the rates of climb of to-morrow will no doubt exceed even the high figures of to-day. This physiological problem, like the others to which we have referred, is under constant study, both in flight and in the more easily controllable conditions of the low-pressure chambers at Farnborough and elsewhere. One cannot always tell in this new field of human endeavour what the future may have in store, and careful foresight is needed to prevent one from being caught napping.

Engineers and Men of Science

IN *Nature* of September 12th the Editor proclaims that he "has never recognised any distinction between men of science and engineers; the latter are a class of the former," and adds that "The tendency in some quarters to make an unnecessary distinction is confusing and sometimes leads to friction." We are sorry to differ with our scientific contemporary, but we must say that the distinction is necessary and that it is when it is *not* made that confusion and sometimes friction occurs. We may add that whilst we know some engineers who actually resent being called scientists, we know none except those who have taken up scientific work who show any ardent wish to be classed as men of science. Just as the surgeon prefers to be called Mister instead of Doctor, so the engineer likes to be called "engineer," not "scientist."

Various appointments made by Ministries set up during the war give the indelible impression that there are persons in high places who believe that any man of science must be competent to tackle engineering problems. Oddly enough, they have never, seemingly, taken the opposite view, that any engineer can deal with any scientific subject. Of course, neither view is correct. The physicist, the biologist, the chemist, is no more competent to deal with engineering problems than is the engineer competent to handle questions in physics, biology, or chemistry. Engineering is in essence a craft. It is concerned with the design and making of things and with their use when made.

Knowledge of the properties of materials is, of course, essential, but it is a very practical kind of knowledge, and the use of it becomes very soon a matter of routine. The machine operator does not have to think scientifically about feeds and speeds for different materials. They have been settled by test and experience. The design of mechanisms, even complex things like those in lace-making, bottle-making, type-casting machines, and so on, calls for common sense and lots of knowledge of what can be done, far more than for science in any reasonable connotation of that word. It is of interest to notice in this connection that chemists have recognised this difference between the scientific worker and the man engaged upon the mechanical applications of chemical discoveries. They established an Institution of Chemical Engineers. We may recall, too, that all our great engineering institutions insist that their members shall have practical experience in the workshop or the field. If science alone would serve to make engineers, then this qualification would be unnecessary. When we add that pure craftsmen, like the members of the A.E.U., are allowed to call themselves engineers, it is more than ever evident a distinction between men of science and engineers must be made.

Some day, despite all the difficulties it presents, the problem of settling the status of engineers will be solved. That the position is very unsatisfactory has been made all too clear by the attitude of the Government and the Ministries to engineers. One may see in it a deplorable misunderstanding of what engineers do and of the kind of problems they, and they alone, can solve. The Government and the public think even now in terms of science; they fail to see that technology, and particularly workshop technology, is the primary factor in output, and, in the majority of subjects, in design. The scientist may provide the means of doing things, may discover faults and suggest remedies; but when production begins the engineer in the drawing-office and the factory is paramount.

Letters to the Editor

(We do not hold ourselves responsible for the opinions of our correspondents)

ENGINEERING EDUCATION

Sir,—I have read Mr. Russell's reply, published in your issue of September 11th, to my proposals on engineering education, and since the contentions he puts forward at the beginning of his letter make it appear that my proposals are not practicable from the financial point of view, I would submit the following estimates on which I based my proposals:—

	£
Elementary education, age five to eleven, at £50 per annum	300
Preparatory education, age eleven to fourteen, at £100 per annum...	300
Secondary education, age fourteen to eighteen, at £100 per annum...	400
Continental university education, age eighteen to twenty-one, at £250 per annum	750
Practical training, age twenty-one to twenty-two—self-supporting pocket money, say ...	100
Technical training, age twenty-two to twenty-four—self-supporting pocket money, say ...	200
Practical training, age twenty-four to twenty-five—self-supporting pocket money, say ...	100
Present at end of education to provide "margin"	300
	£2450

The above expenditure can be provided on the basis of an annual investment of £72 10s., assuming that a net return on investment of 5 per cent. is available. This conclusion is arrived at as follows:—

	£
£72·5 invested annually at end of year at 5 per cent. compound interest yields over five years...	402
The sum of £402 left in for six years at 5 per cent. compound interest becomes...	538
£22·5 invested annually at end of year at 5 per cent. compound interest yields over six years	153
Total available at age of eleven...	£691

During the next seven years £100 is abstracted annually at the commencement of the year and £72 10s. added at the end of the year, the balance being left in at 5 per cent. The net result for these seven years is a balance of £708 at the end of the eighteenth year.

From eighteen to twenty-one £250 is abstracted at the commencement of each year and £72 10s. is added at the end of the year and the balance is again left in at 5 per cent. This results in a balance of £346 at the end of the twenty-first year.

During the last four years £100 is taken at the commencement of each year and £72·5 is added at the end of each year, the balance being again left in at 5 per cent.; this results in a balance of £280 being available at the end of the twenty-fifth year. To this has to be added £20 to provide the £300 "margin" for the young engineer setting out on his career.

On this basis I estimate that anyone having an income of £500 at the age of thirty, £600 at thirty-five, and £700 at forty would be capable of providing the education I outlined for three children. N. V. Pestereff.

Edinburgh, September 22nd.

EDUCATION AND THE WAR EFFORT

Sir,—I think that Mr. F. L. Mayer's objection to the point of my letter is not quite supported by reference to the unanswered questions of moral philosophy. One may believe that there is an answer to every question if it is presented in a true light. The ability to maintain this attitude is itself the surest safeguard against the fatal boredom to which he refers.

I think that our only difference is concerned with the true interpretation and direction of the human economy.

Is technical competence able to sustain this *rôle?* Many will believe that it is not.

One does not withhold one's tribute from technical accomplishments as such. One simply refuses to confuse the instruments of utility with the purpose which they serve.

This purpose is the thing which really matters. What is the standard which shall govern its direction?

It seems to me that the limitation of physical science is illustrated quite well by the example which Mr. Mayer, himself, has chosen. If the great cities of the world are to be equally accessible with our own, then obviously the stimulus of their remoteness will disappear

This is simply to state a single example of an inevitable tendency.

It is this inevitability which points to a fundamental deficiency in our educational standards.

This distinction apart, I am pleased to note Mr. Mayer's success in the matter of the Engineering Association which he advocates. May it prosper! R. G. Griffiths.

Bristol, September 24th.

"SPEED AND CONVOY"

Sir,—It may be true that, in view of the highly satisfactory results obtained with convoys with 12-knot ships, it is difficult to expect better results with high-speed armed merchant units sailing unprotected; but there is also another important factor, *i.e.*, it is necessary to have certain goods delivered as quickly as possible.

Therefore, would it not be worth while having in addition a separate "express convoy" with much faster ships? After the war, the merchant ship will become the most important ship on the sea, so why not start now with the development of a highly modern type? How many such types of ships could be built and made use of during the war it is impossible to forecast, but in developing this new type it is essential to avoid half measures and to get right away from old ideas. If steam is used, the ships have to be equipped with high-pressure turbines, forced circulation boilers, and simple reliable electro-propulsion. So far, only half measures have been adopted in this direction in this country to ships as a whole, to say nothing about merchant ships.

If a completely new type of fast merchant ship were developed now it would be very valuable during both war and peace.

Lew Zausmer.

London, September 29th.

MECHANICAL DRAWINGS

Sir,—The letter of "A. C. S. B.," in your issue of the 25th inst., evoked a feeling of sympathy on my part, as I have been up against exactly the same thing in the refusal of the Government to include engineers' drawings for insurance purposes in the same way as other plant.

I suppose we were like many others and never realised that total destruction of a works and everything in it was possible, or even likely; but since insurance is the policy of all carrying the risk for anyone who may suffer, the fact that many firms have been fortunate does not alter the principle.

Presumably, some pressure must have been applied to the Board of Trade, as working drawings are just as much plant as are patterns or even machine tools, but somehow such drawings in the official mind seem to be confused with works of art or pictures, &c.

Anyhow, having unfortunately lost everything, I can say with truth that the cost of replacing, involving a large staff for at least a year or so, has in one case run into some £10,000, apart from the dreadful difficulties of having to reconstruct everything with nothing to work from.

If it is held that the present Act rules out engineers' drawings, then most certainly an enabling Act should be passed to put right this obvious injustice. H. P.

September 28th.

BOOKS RECEIVED

The Coals of South Wales. London: H.M. Stationery Office, Kingsway, W.C.2. Price 1s. net.

Water Weeds and their Eradication from Canals. By C. C. Inglis. India: Central Board of Irrigation, Simla.

Aero-Engines. By D. Hay Surgeoner. London: Longmans, Green and Co., Ltd., 43, Albert Drive, S.W.19. Price 3s. 6d. net.

Town Planning and Road Traffic. By H. A. Tripp. London: Edward Arnold and Co., 41–43, Maddox Street, W.1. Price 10s. net.

Munitions Girl. By Caroline Haslett. London: English Universities Press, St. Hugh's School, Bickley, Kent. Price 1s. net.

Modern Milling Practice. By E. T. Westbury. Maidenhead: Percival Marshall and Co., Ltd., Cordwallis Works. Price 2s. 6d. net.

Specification, 1942. Forty-fourth year. Edited by F. R. S. Yorke. London: The Architectural Press, 45, The Avenue, Cheam, Surrey. Price 15s. net.

Producer Gas Plant for Industrial Purposes. London: The National Federation of Gas Coke Associations, 1, Grosvenor Place, S.W.1. Price 5s. net.

Military Railway Service of the United States Army

HISTORY and organisation of the Military Railway Service as an adjunct of the United States Army has been described recently in a lecture to the Western Society of Engineers by Mr. Carl R. Gray, who is Manager of the present Service, and is also executive vice-president of the Chicago, St. Paul, Minneapolis and Omaha Railroad. The first use of railways in war service in the United States came with the Civil War of 1861, when the Government—realising that the railways in a theatre of operation must be under the absolute control of military authorities—secured the passage of a law authorising the President to take possession of the railways and telegraph lines and put them under military control. This power was never utilised, as the railways were highly patriotic and gave every facility for military service. At the same time, it was realised that in occupied territory it would be necessary for a professional railwayman of ability and understanding to take charge of the military railway operations.

During the World War of 1914–18 an extensive and comprehensive Military Railway Service was organised, at first with eight regiments. The colonels and adjutants were officers of the Regular Army, and the other officers were experienced railwaymen. In all, fifteen units with 69,000 enlisted men and officers were organised and sent to Europe, under the direction of Mr. W. W. Atterbury, then vice-president of the Pennsylvania Railroad, and having the rank of Brigadier-General. After the war, however, the organisation was disbanded.

With the imminence of war in Europe, at the beginning of this Second World War, the Chief of Engineers, U.S. Army, revitalised the Military Railway Service, with Colonel Charles D. Young, vice-president of the Pennsylvania Railroad, in charge of the mobilisation assignment as Chief of Railway Section, Office of Chief of Engineers. Studies indicated that the minimum requirements would call for ten grand divisions and six shop battalions. As it was impossible to secure the increase to take care of the proposed additional units, the organisation was initiated with five grand divisions and three shop battalions, while twenty-two operating battalions will be formed by the sponsoring railways when and if needed. The geographical distribution is not ideal, but the units must be thickest where there are the most railways. The railway companies have co-operated actively in accepting affiliation with the Service, and in providing officer personnel.

Since military railways are an engineer supply organisation, they function under the Commanding General, Communications Zone, through his engineer. The departmental divisional organisation is essentially transportation, stores, engineering, equipment, and administration in headquarters. But the basic unit for transportation and maintenance is the railway operating battalion, on a railway division of 75 to 100 miles, depending upon the density of traffic to be handled. Greater latitude of responsibility and action must be allowed the commanding officer of the battalion as division superintendent than is usual in commercial railway operating practice. The reason is that a military situation is constantly changing.

Thus, trains started from supply bases in the rear may or may not reach their destinations in the combat zone. A trainload of one commodity has to be broken up and trains reassembled to reach the troops with all necessary articles of supply. The key to this traffic control is the regulating officer, who functions directly under general headquarters. He is assisted by a superintendent or general superintendent of the Military Railway Service. He controls the trains from the rear into his regulating station; makes up and dispatches trains towards the front; designates the railheads; and ensures return of equipment and its evacuation.

There are no construction troops under the direct control of the Manager, Military Railway Service. New construction is carried out by the general engineer troops of the Army and Communications Zone. Some railway officers, however, favour construction units as part of the Service organisation, since it is doubtful if railway construction troops will be available on call or that sufficient labour will be available when needed. Mr. Gray favours a nucleus formed by two general service regiments, specially trained in railway construction, under the Military Railway Service. Additional construction troops can be attached as needed.

As a start, one battalion was formed as the 711th Railway Operating Battalion, and two battalions assisted in building a railway between two camps. Later, the battalions were engaged in regular railway duties. There is a military training centre at which some force will always be training, and where the railway reserve forces can go for short periods to learn their military duties to better advantage. The officers have been drawn from ten railways, and have quickly welded themselves into a real unit. The similarity between military and railway organisations is marked, and it is found that railwaymen become soldiers in a very short time.

In brief, the organisation of the units of the Military Railway Service is as follows:—(1) Railway Service, Engineer Headquarters. This corresponds to the operating vice-president's organisation on a standard American railway. (2) Railway Grand Division Headquarters. This corresponds to a railway general manager's or general superintendent's office force and organisation. (3) Railway Operating Battalion. This is the basis and heart of the Service; together with (4) Railway Shop Battalion, which does the heavy overhauling of locomotives and cars for the operating battalions. The Engineer Headquarters (Railway) comprises at present 24 officers and 216 enlisted men. It is divided into a Headquarters Detachment, Transportation Department, Track and Structures Department, and Stores Department. The officers assigned have appropriate railway titles. Thus the commander of the Military Railway Service is known as the Manager. He has an *aide*, and is provided with a colonel of engineers from the Regular Army as assistant to the Manager for *liaison* purposes with the Army Command. The commander of the Headquarters Detachment is the Adjutant, and handles the messing and quarters for the headquarters troops.

The chief of the transportation department is known as the General Superintendent of Operations, and has under him an Assistant General Superintendent, Superintendent of Water Service, Superintendent of Terminals, and Superintendent of Telegraph and Telephone. The chief of the equipment department is known as the Chief Mechanical Officer, and his assistants are a General Superintendent of Motive Power, Superintendent of Cars, Assistant Master Car Builder, and Assistant, Car Department. In the track and structures department, the chief is the Engineer of Maintenance of Way, and he has an Assistant Engineer Maintenance of Way, Engineer of Bridges, Signal Engineer, Water Supervisor, Supervisor of Work Equipment, and an Assistant Engineer of Track. In the stores department the chief is the General Storekeeper and he has a Fuel Agent.

The Engineer Headquarters — Railway Grand Division (of which five have been authorised) is divided into an administration section, transport section, water treatment section, engineering section, equipment section, and stores section. It consists of 24 officers and 74 enlisted men. The commanding officer, who has the military rank of Colonel, is General Superintendent. He has an Assistant General Superintendent of Transportation, Engineer of Track and Structures, Assistant Superintendent of Car Service, Superintendent of Equipment, General Storekeeper, Chemical Engineer, Assistant Engineer of Structures, Master Mechanic, Master Car Builder, Mechanical Engineer, Supervisor of Water Service, and Fuel Engineer. The captain who commands the administration section is the Adjutant for the Colonel Commanding, and this section takes care of the messing and quarters of the troops of the Grand Division Headquarters.

In each of the twenty Operating Battalions the Division Superintendent is a Lieut.-Colonel, with 18 line officers, 3 medical officers, 803 enlisted men, and 17 enlisted medical men. The battalion is divided into a Battalion Headquarters, Headquarters and Service Company; Company A, maintenance of way; Company B, maintenance of equipment; and Company C, transportation. The Assistant Division Superintendent is the Major, with a Captain as Adjutant; and the commander of the Headquarters Company is the Division Storekeeper, who also is a Captain. The Headquarters and Service Company is further divided into a company headquarters, administrative section, technical section, supply and transport section, mess section, train movement section—which is the dispatching force—and signal maintenance section.

This Headquarters and Service Company consists of 6 officers and 106 enlisted men of special training; Company A has 4 officers and 190 enlisted men; its commander is Engineer Maintenance of Way, with a Supervisor of Bridges and Buildings, Supervisor of Track, and Assistant Engineer of Maintenance of Way. The company is divided into two platoons—a bridge and building maintenance platoon and a track maintenance platoon.

Company B consists of 4 officers and 182 enlisted men. Its commander is Master Mechanic, with a Mechanical Engineer, an Engine-house Foreman, and a General Car Foreman. It also is divided into two platoons—a locomotive repair platoon and a car repair platoon. Company C—Transportation has 4 officers and 325 enlisted men. Its commander is a Trainmaster, with a Yardmaster and two lieutenants who are travelling enginemen or road foremen of engines. The company is divided into two train-operating platoons, each with 25 train crews.

In the Railway Shop Battalion, of which three are now authorised, the commander is a Lieut.-Colonel as General Shop Superintendent. There are 23 officers and 658

enlisted men, including 3 medical officers and 16 enlisted medical men. This organisation has a Battalion Headquarters ; Headquarters and Service Company ; Company A, erecting and machine shop ; Company B, boiler and blacksmith shop ; Company C, car repair shop.

The approach made by the War Department, through the Chief of Engineers, concerning these units of the Military Railway Service, was to ask the railway companies to accept sponsorship or affiliation of the units. The railways have responded generously, and the principal difficulty has been in securing experienced men who are not too old or too young for the appropriate Army rank, and who are able to pass the required physical examination. Many of these railway officers saw service in the former World War, and have been serving in reserve commissions since that time. With the organisation and line of authority so similar in the Army and the railways it is believed that the railway officers will fit well into their new assignments and provide a Military Railway Service that can and will accomplish the mission of this Service, which is to operate the railways in any theatre of military operations.

Steam Traps*

By G. F. BROWN

IN the employment of steam as a condensing vapour, its transmission and applications (heaters, &c.) produce condensation, in the first case unavoidably, and in the second by design, and unless the condensate is collected and removed, without loss of steam, completely and as rapidly as possible, the plant cannot be worked with maximum efficiency. As steam plant is generally of high capital cost compared with the outlay necessary for efficient drainage, it is essential to study and take the greatest care with this part of any steam plant.

Dealing first with steam distribution lines, it is well known that serious damage can be done if "water hammer" occurs. To understand and eliminate the phenomenon, it must be realised that condensation from saturated steam takes place continuously at the pipe surface. Thus transmission occurs through a film of water which drains to the lower arc of the pipe. The steam travelling over the top of this water causes a wave motion which may grow to the full diameter of the pipe. Then the wave is driven forward at the steam velocity, and this, combined with spontaneous steam cooling, causes violent "water hammer." Hence, drip points and traps must be installed at such intervals as will eliminate the wave motion entirely. They should always be installed at all natural drip points, such as in front of inverted loops and at the bottom of hanging loops and supply risers. Otherwise a spacing of 200ft. with a possible variation either way, depending on local conditions, is usually satisfactory. In addition, a trap of ample capacity should be installed in a suitable position to remove any priming from the boiler.

Having determined the length of line to be drained, a suitable size of steam trap must be chosen, and here the determining factor is whether or not the line is on intermittent duty. If it is, the weight of pipe between the drip points should be estimated, and the heat required to raise this length of pipe to saturation temperature calculated. The amount of steam condensed must then be converted to an hourly basis by multiplying by 60 and dividing by the time in minutes required to heat up. Six minutes is a reasonable period to allow, and if a longer time is taken by admitting the steam gradually, the same sized trap would still have to be used because with lower differential pressure across it its capacity will be lower. Furthermore, the trap must also handle all the air which initially filled that portion of the pipe so that a safety factor of $1\frac{1}{2}$: 1 should be used.

If the pipe is always full of steam, the trap need be only large enough to handle the condensate due to radiation losses (excepting that which must handle boiler priming), and this may be calculated from radiation figures.

In an appendix are given two tables giving the heating up and radiation losses per foot of uninsulated pipe. If the efficiency of lagging is known the conversion can be made, but it is not unsound practice to size steam traps on the basis of unlagged pipe.

Before leaving the subject of removal of condensate from steam mains it might be well to mention that it is useless to provide a suitable trap if the condensate never reaches the trap, and that now that welded piping is becoming so common it is a comparatively simple matter to provide either a drip pocket or a small dam tack welded on the bottom of the pipe on the downstream side of the drip connection. So often in the past drip pipes have been merely screwed into the bottom of the steam header and some water will almost certainly be carried past them.

As so much damage can be done to turbines and reciprocating engines by wet steam or slugs of water, special care should be taken in selecting and installing all traps so associated. For example, if a spray type desuperheater is supplying steam to a turbine the steam trap draining the desuperheater body or separator should be capable of handling all the water which the injection nozzle or nozzles can pass. Thus in the event of failure of the control mechanism the separator would not flood.

It is outside the scope of this paper to discuss the various systems used to return the condensate to the boiler, but when selecting a trap its suitability or otherwise for the method adopted should be borne in mind. Due consideration should be given, for instance, to the reduction in capacity when a trap is being used to elevate the condensate, owing to the reduction in differential pressure across the trap. If a vacuum return is employed the traps must be suitable for the total differential pressure and also of such a capacity as not to cause waterlogging should the vacuum be lost or greatly reduced.

In all heating and process apparatus designed to utilise the latent heat of steam failure to remove condensate materially reduces the heating capacity. This is due partly to the actual reduction of steam space, but more substantially to a far greater resistance to heat transmission of the stagnant water film. Thus artificially to cut down the effective size of the unit is obviously a costly practice with apparatus specifically purchased for its heating capacity.

The water could be drained by means of a hand valve at the lowest point of the line or unit. As, however, in most cases the rate of condensation will vary, frequent adjustment of the valve would be necessary if banking up or blowing of steam was to be avoided. It usually happens that the valve is set so that all the condensate and some steam is passed, and while the loss due to sluggish removal of water may be hard to visualise, the loss due to even the smallest steam leak cannot be discounted. The losses which may be expected are shown in Table I, which is based on steam raised at a cost of 2s. 6d. per 1000 lb.

Thus an automatic means of removing water from steam should be considered essential.

There is a further important, though less obvious duty, which such a device should perform, that is, it should be capable of air removal. Most steam raised for heating contains air or other non-condensible gases, and steam diluted with air has a lower temperature than pure steam as shown in Table II.

TABLE I

The steam pressure is taken as 100 lb. per square inch.

Size of orifice.	Lb. of steam wasted per month.	Total cost per month. £ s. d.	Total cost per year. £ s. d.
$\frac{1}{4}$in.	835,000	104 7 6	1252 10 0
$\frac{3}{8}$in.	470,000	58 15 0	705 0 0
$\frac{1}{2}$in.	210,000	26 5 0	315 0 0
$\frac{3}{4}$in.	52,500	6 11 3	78 14 0
1in.	13,200	1 13 0	19 16 0
$1\frac{1}{4}$in.	3,400	8 6	5 2 0

Apart from the actual reduction in the temperature of the steam, there is a reduction in the heat transfer capacity, and a recognised American expert on heat transfer has given it as his opinion that under extreme conditions the presence of $\frac{1}{2}$ per cent. by volume of air mixed with steam can reduce the heat transfer coefficient by 50 per cent.

The American Institute of Laundering has published the results of a survey, in which it demonstrates the importance of maintaining 100 lb. steam pressure in laundering equipment,

TABLE II

Table Showing Temperature Reduction Caused by Air at Various Pressures

Gauge pressure.	Temperature of steam with no air present.	Temperature of steam mixed with various amounts of air (per cent. air by volume). 10 per cent.	20 per cent.	30 per cent.
10·3	240·1	234·3	228·0	220·9
25·3	267·3	261·0	254·1	246·4
50·3	298·0	291·0	283·5	275·1
75·3	320·3	312·9	304·8	295·9
100·3	338·1	330·3	321·8	312·4

by showing the effect of steam pressure on drying time. One of the tests showed that at 100 lb. pressure 15·5 seconds were required to iron a cuff, at 90 lb. pressure 21 seconds were needed, and at 80 lb. pressure 26·5 seconds were required. But if 9 per cent. of air is present in a machine in which the pressure is 100 lb. gauge. the actual pressure of the steam is 89·95 lb. per square inch gauge, and drying time would consequently be increased by 35·4 per cent. Similarly, with 17 per cent. of air the laundry operative would be no better off than with 80 lb. per square inch steam pressure, and drying time will be increased by 70·9 per cent. Laundry machinery has been used to illustrate the point because figures were available, but to obtain the greatest economy and consequently use with the greatest efficiency, all steam heat exchangers must have air continuously vented.

Owing to the fact that in the past sufficient attention has not been given to the proper sizing of steam traps and rapid removal of air, a belief has grown up among many engineers that trapping will increase the time for heating up from cold. The impression is false if sound principles are followed. The problem is not only to remove the air entrained in the steam and the large volume of condensate produced at low pressure, but also to remove quickly the air which initially fills the apparatus. For this purpose thermostatically operated air bypasses have been fitted into mechanically operated steam traps with excellent results. Tests carried out on 15-gallon and 50-gallon copper kettles and also a 100-gallon aluminium

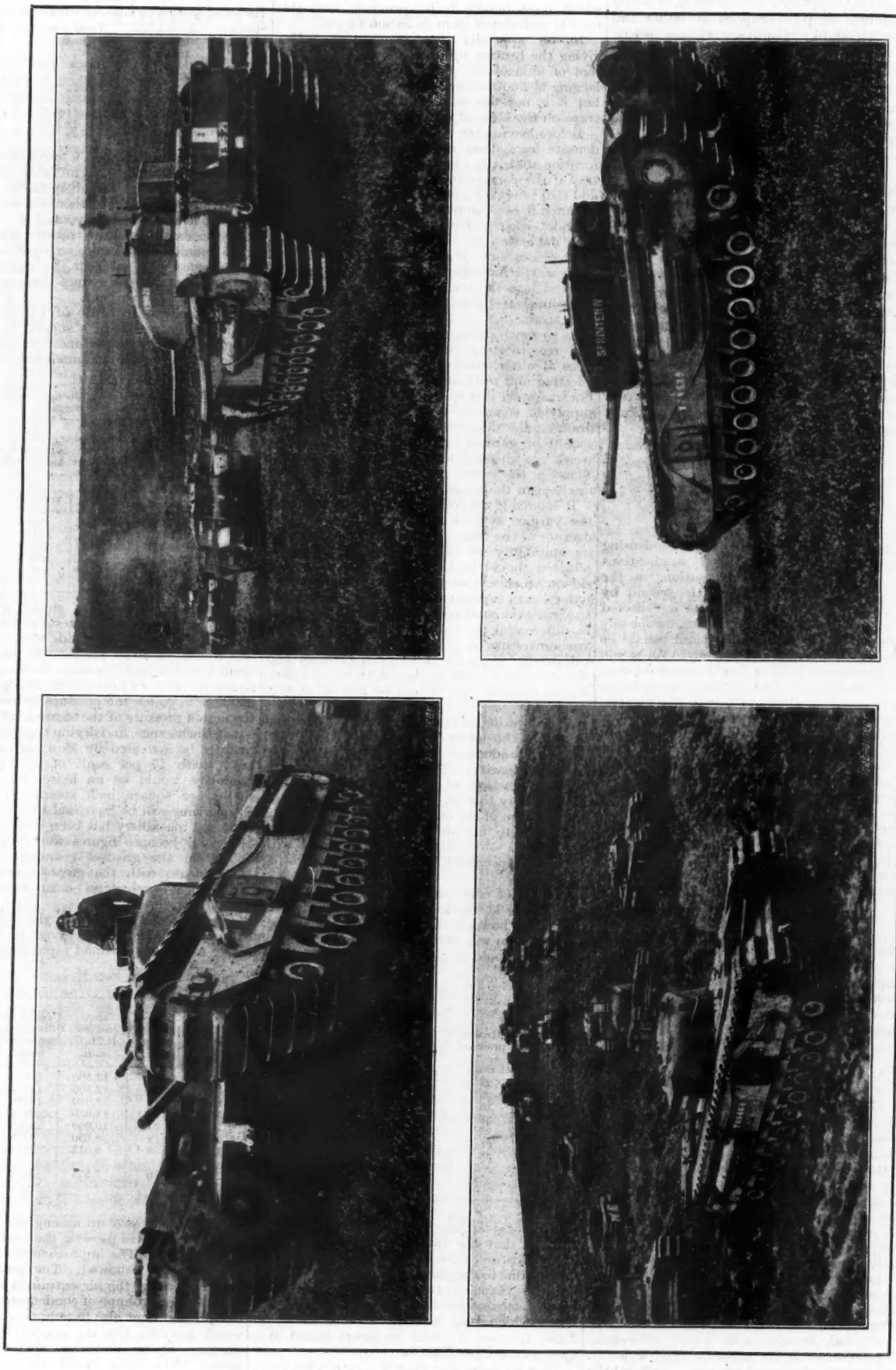
TABLE III

End of minute No.	Header pressure.	Inlet pressure.	Kettle (outlet) pressure.	Steam temp. in jacket.	Water temp. in kettle.	Water temp. rise.	Heat added B.Th.U. min.	Temp. diff. between water and steam.	B.Th.U. per sq. ft. per hr. per °F. temp. diff.
1	25	18·5	5·5	228·5	73	30	12,500	170·5	393
2	25	19·0	8·5	235·9	103	30	12,500	147·4	455
3	26	20·0	11·0	241·5	132	29	12,080	124·0	521
4	26	22·0	13·5	245·6	160	28	11,670	99·6	625
5	27·5	24·0	18·0	255·3	184	24	10,000	83·3	642
6	28	26·0	19·5	257·9	203	19	8,650	63·9	725
6·25	28	26·0	20·0	258·8	212	9	9,012	51·3	940
12·25	27·5	26·0	Evaporating for six minutes 22·0	262·2	212	0	7,975	50·2	850

* Institution of Engineers-in-Charge, April, 1942. Abstract.

"CHURCHILL" TANKS

(For description see opposite page)



kettle, while using such a trap, have been made, and the detailed results of one of the tests on the 100-gallon kettle are shown in Table III.

This clearly shows the effect of air on heat transfer. Note how the heat transfer rate (figures in right-hand column) increases with each successive minute due to elimination of air from steam space. A summary of the results obtained with the same 100-gallon kettle when drained as above, when using a $\frac{1}{8}$in. orifice, and when drained by blowing through a $\frac{1}{4}$in. pipe are given in Table IV.

TABLE IV

Summary of Tests on 100-Gallon Aluminium Kettle

	Kettle drained by		
	No. 213 with air by-pass.	Restricted blow through $\frac{1}{8}$in. orifice.	Unrestricted blow through $\frac{1}{4}$in. pipe.
Minutes required to heat 417 lb. water from 43 deg. Fah. to 212 deg. Fah....	6·9	7·7	8·6
Pounds of steam required to heat 417 lb. water from 43 deg. Fah. to 212 deg. Fah. ...	85	90	105
Pounds of steam used per pound of water evaporated	1·24	1·33	1·64
Pounds of water evaporated per minute...	8·4	7·6	6·4

Here we seen that, owing to the lower steam pressure in the jacket, when a steam trap is not used, boiling time is increased, and that the larger the blow through, the longer the time required. The wastage due to allowing uncondensed steam to escape is also clearly shown.

Sterilisers must be heated just as quickly and positively as jacketed pans. Those of the autoclave type are often drained, either by a cracked valve or valves, or by one trap on both jacket and chamber. In the former case we have seen that steam wastage and low pressures will decrease the efficiency. In the case where one trap drains both jacket and chamber, what is known as "short circuiting" occurs, of which more later. The jacket is usually kept full of steam the whole time, so that any reliable trap which will continuously remove entrained air may be used. The chamber is used intermittently, so that a trap with thermostatic air by-pass or a purely thermostatic trap should be used.

The incidence of "short circuiting" opens a fruitful field of potential trapping failure, and may occur whenever two or more units are drained by one trap. For example, if three kettles are drained by a single trap and one kettle is filled with a cooler liquid than the other two, this kettle will condense more steam and consequently the jacket be at a lower pressure than the other two. As a result steam will flow into the kettle from the common return line and possibly prevent the escape of condensate and certainly prevent the escape of air. Fitting a check valve in the drain line from each kettle will not prevent this trouble, because as long as the pressure in the common return line is higher than that in the kettle, the check valve will remain closed and condensate will not be relieved until it has built up a standing head equal to the difference in pressure. The drain from this kettle can never, therefore, be entirely free from condensate, and consequently air can never be removed as long as its pressure is lower. In time the heat

TABLE V.—*Four-roll Ironer*

Chest No.	Temps. with one trap. Deg. Fah.	Temps. with individual trap. Deg. Fah.
1	273	330
2	292	327
3	300	344
4	314	346
Average	295	337

Average increase, 42 deg.

transmission of the air-bound kettle is reduced to such an extent that its pressure becomes equal to the other pans.

Tables V and VI show the results of tests made with a surface pyrometer of the temperatures of a four-roll and six-roll ironing machine when one trap drained each machine and when a separate trap drained each chest.

The autoclave type steriliser, previously mentioned, furnishes another example of inefficiency due to "short circuiting" when both the jacket and chamber are drained by one trap.

Presses for rubber and plastic, &c., should, for

TABLE VI.—*Six-roll Ironer*

Chest No.	Temps. with one trap. Deg. Fah.	Temps. with individual trap. Deg. Fah.
1	250	308
2	280	310
3	270	310
4	255	311
5	250	318
6	260	320
Average	261	313

Average increase, 52 deg.

highest efficiency, have each platen drained individually by a steam trap. If this is not done, "short circuiting" should be prevented by connecting the platens in series. This method of making the connections provides heat transfer superior to the parallel method, but vastly inferior to the individually trapped method.

It is, of course, impossible to go into all the common examples of poor drainage due to "short circuiting," but what has been said will no doubt suffice to show their cause and cure.

The "Churchill" Tanks

SINCE it has been officially stated that "Churchill" tanks were used in the Dieppe raid and that some of them were left in the enemy's hands it is now permissible to give a few pictures of them.

On the opposite page several types are illustrated, but the principal visible difference is only in the armament carried. The tank bodies, the nine carrying wheels or "bogies" on each side, the tracks, the engines, transmission gear, and so on, are common to all. The tank bodies, like the turrets, are made of hardened armour plate. The "Sprintern" represents the latest type. It has a 6-pounder gun in the turret, beside which can be seen the barrel of a coaxial machine gun—that is, a machine gun which is trained with the 6-pounder, but can be fired separately. The bulge seen on the side near the stern contains the air intake louvres for cooling the radiators, which are just behind it. Right at the back is a supplementary petrol tank, which can be jettisoned from inside the tank.

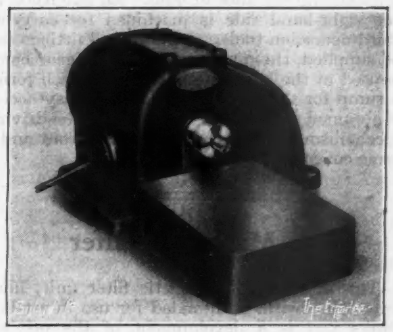
The means of carrying the "bogies" on short radius arms with helical compression springs can be gathered from the illustrations.

In the front end views the driver's visor can be seen beside the lower gun, but the absence of the sand shields which protect the driver from dirt thrown up by the tracks may be noticed. They are, of course, fitted when necessary.

In one picture the tank has a 2in. gun in the turret and a 3in. howitzer below. In other views other gun arrangements may be seen. When the 6-pounder is mounted it is always in the turret, never below.

A Mechanical Handle for Gauges

SOME inspection jobs can become very monotonous and tiring, and as a result production is bound to suffer. The examining of threaded components in any quantity with either ring or plug gauges can be placed very high in the list. To obviate this drawback as much as possible the Edgwick mechanical handle, shown in the accompanying engraving, has been evolved by Alfred Herbert, Ltd., Coventry. The machine is self-contained and is provided with electrical equipment for 440 volts A.C. current. It is stated that it has been able to show savings up to 500 per cent. Its use does not entail any special training, so that an unskilled operator can quickly learn to use it with good results. The very light and sensitive spindle floats endwise in plain bearings, and by means of a suitable collet or adapter holds the screw plug or ring gauge. Both left and right-hand threads can be dealt with. In use the machine is first switched on to the appropriate position for the hand of the gauge. The spindle remains stationary until a light end pressure (about 7 oz.) is applied by the operator presenting the component to the gauge. A reversal of the pressure immediately alters the direction of spindle rotation, and with all pressure relaxed the spindle comes to rest at once. The sensitivity of the spindle closely resembles the feel of the human hand, and since



MECHANICAL HANDLE FOR GAUGES

the torque is adjustable no harm, we are informed, will be caused should the gauge jam. The distance from the centre of the spindle to the top of the table is $2\frac{1}{2}$in. and the spindle runs at 290 r.p.m.

A Six-inch Three-Operation Lathe

ALTHOUGH elaborate and expensive machines should never be used for performing simple operations, it often happens that there is no simple machine available for doing many of the plain turning, facing and boring operations and consequently a more elaborate machine has to be utilised. In order to avoid this difficulty the Edgwick 6in. three-operation lathe has been designed and built by Alfred Herbert, Ltd., of Coventry. It is a self-contained machine,

THREE-OPERATION LATHE

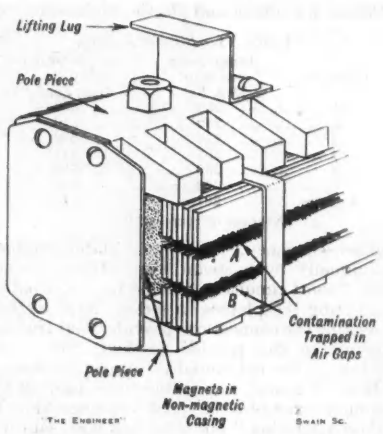
having its own motor housed in the cabinet base. A choice of three $1\frac{1}{2}$ H.P. motors is given, two with single speeds of 960 r.p.m. and 1440 r.p.m. respectively, or a two-speed motor having both these speeds, all suitable for A.C. current of 400/440 volts, three-phase, 50 cycles. The motor drives the main spindle through a three-step cone pulley jack shaft. The drive to the jack shaft is by vee belt and from the cone pulley to the spindle cone by a flat belt. Both belts are tensioned and the number of spindle speeds are three and six respectively with single and two-speed motors.

The spindle is bored through and flanged to

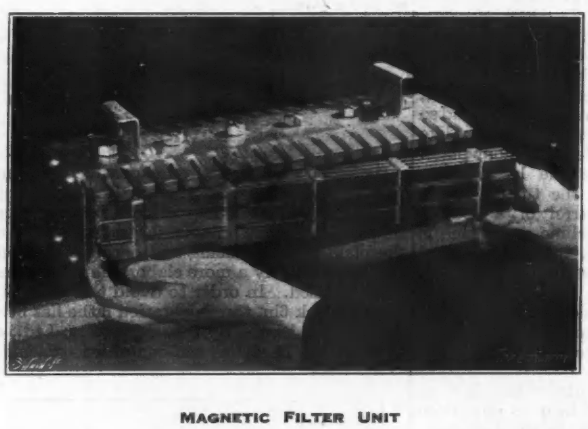
carry a 6in. chuck, runs in plain bearings and is provided with a ball thrust washer at the rear end. It is started, stopped, and braked by the taller of the two levers at the front of the machine, whilst the shorter one operates the two-speed motor when it is supplied. If required, a collet chuck with a maximum capacity of 1¼in. diameter can be fitted. The saddle has a plain hand-operated cross slide fitted with adjustable stops and carries front and rear tool posts. If required, a square turret can be fitted in place of the front tool post. The saddle is traversed along the bed by a hand wheel for a maximum distance of 4½in. An extension at the right-hand side is machined for carrying third-operation tools. A pump and fittings can be supplied, the pump and its switchgear being housed in the base, the bottom of which forms a sump for the cutting lubricant. Easy access is obtained to all these parts, and to the driving mechanism through the door in the front and a large cover at the rear.

A Magnetic Filter

The new Philips magnetic filter unit, illustrated herewith, is intended for use in settling tanks and is a development of the original Philips magnetic filter designed to be fitted in a pipe line carrying a coolant or lubricant. It is made by Philips Industrial (Philips Lamps), Ltd., of Century House, Shaftesbury Avenue, W.C.2. On certain operations such as grinding, a filter of large capacity is required to deal with the quantity of swarf which is thrown into circulation. This new settling tank filter is designed to incorporate three or six permanent magnets, made of the recently developed directional "Ticonal" alloy. This material is claimed to have an energy product approaching three times that of the best permanent magnet alloy previously available. The grade of "Ticonal" chosen for this particular application is "Ticonal" 42/50, on account of its high coercive force. The magnets are enclosed in a non-ferrous case and are connected in parallel by pole pieces, between which and on either side of the magnets are two cages, the design of which is shown in the diagram. It will be appreciated that the spaces A and B constitute air gaps and it is here that ferrous contamination is trapped. The normal method of fitting this settling tank filter is to place it in a wooden trough with 1½in. to 2in. clearance all round and to install it below the last of the settling tanks, so that the final operation in purifying the liquid is the removal of the very fine ferrous particles which are not trapped by the settling tanks.



Arrangement of Filter Unit



Magnetic Filter Unit

The Philips filter is not intended to replace the usual filtering methods which adequately deal with the coarser contamination. It is designed to extract the very fine particles which remain in suspension in the liquid, after it has passed through the normal filters.

It will be seen from the half-tone illustration that the filter unit has two lifting lugs. When the filter is fully contaminated it is withdrawn from the trough. The cages are removed in turn and, as they are then non-magnetic, cleaning is quickly performed, either by washing or by the use of a compressed air jet. The cleaned cages are then replaced and the complete unit put back ready for use. This filter unit is at present made in two sizes. The larger will trap between 2 lb. and 3 lb. of fine ferrous contamination before it is advisable to clean it; the smaller size has about half that capacity.

Electric Locomotives for Industry

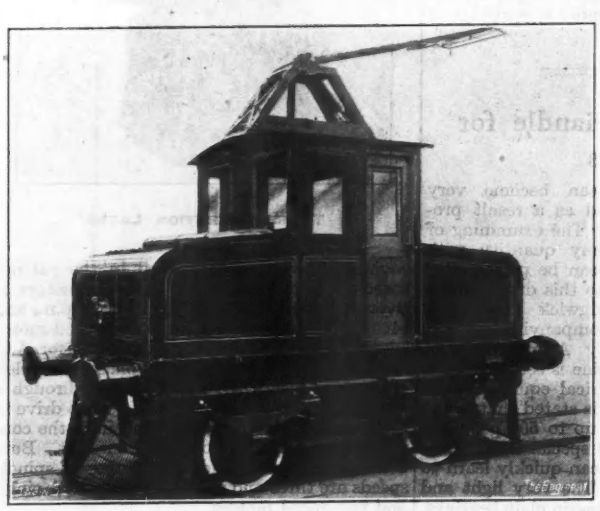
A general utility type of standard-gauge two-axle electric locomotive with a central cab has recently been built by the English Electric Company. This type of locomotive is suitable for battery or for overhead line operation, or for a combination of both, and it can be built to individual requirements ranging in weight from 12 to 24 tons.

The illustrations show a combined battery and trolley locomotive supplied to the Derbyshire and Nottinghamshire Electric Power Company through Messrs. Balfour, Beatty and Co., and an industrial locomotive for operation from an overhead contact wire only, supplied to the Fairfield Shipbuilding Company. These locomotives and others supplied by the E.E.C. are equipped with two standard type traction motors, driving through single-reduction gear, one to each axle. A hand-operated drum type controller in the central cab provides series-parallel operation of the motors. The general characteristics of four of these locomotives are given in the accompanying table.

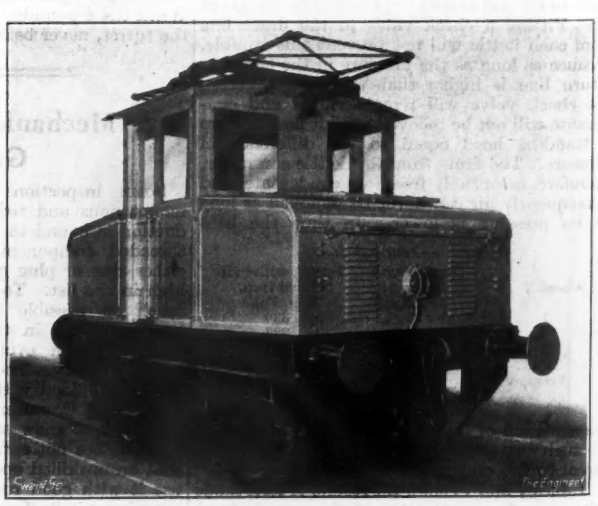
	Derbyshire and Notting-hamshire E.P. Co.	Ayr-shire.	Swin-don.	Fair-field.
Weight, tons ...	20	20	14	22
Voltage (line) ...	300	—	—	500
Voltage (Batt'y)	220	250	200	—
Battery capacity at 5-hour rate in amp. hours	294	252	224	—
H.P.	68	54	31	150
Max. T.E., lb....	11,000	11,000	7,500	12,000

Mechanical brakes are fitted and are operated by a hand wheel inside the cab. The brake blocks are of cast iron, one block to each wheel. In addition, the controller is arranged to provide electric rheostatic braking, which is very useful in cases where the locomotive must hold a heavy train when running down a gradient.

On battery locomotives the battery is housed in the two end compartments, which are painted on the inside with acid-resisting paint and are provided with ventilating louvres cut in the end plates. The covers are rainproof and have cowled openings for ventilation of the compart-



Locomotive for use with Trolley Wire



Battery and Trolley Locomotive

ment. A special method of mounting enables the covers to be swung over the end of the compartments to give a clear opening for inspection or removal of the battery. The battery cells are mounted in crates which in turn are wedged into position in the compartments. In the case of locomotives arranged for operation from an overhead contact wire a variety of means for current collection are available. The illustrations show examples of pantograph and bow type collector gear, but trollies can also be provided. Only the latter method with two trollies can be used when an insulated return is used for the overhead system. The combined battery and trolley locomotive is arranged so that whilst standing under the overhead line the battery is charged automatically. Plain battery locomotives are provided with sockets fitted on a switch panel inside the cab, to which the charging supply can be plugged by means of flexible cable.

Post-War Building Standards Committee

WHEN the Directorate of Post-war Building was set up in the autumn of 1941 a Standards Committee was planned as an essential part of the Committee organisation. The Standards Committee has now been convened by the Ministry of Works and Planning, and it held its first meeting on August 26th, with Mr. Sydney Tatchell in the chair. The terms of reference are as follows :—"To study the application in building of standard plan elements, standard specifications and building components, and methods of prefabrication, with the particular object of ensuring (*a*) economy in the use of material in the post-war period, (*b*) simplified and speedier procedure and construction, and (*c*) wherever possible, improved quality and design. To make recommendations for such standards as well as for standards for terminology and consumer requirements ; to collect, review, and correlate recommended standards put forward by other Study Committees of the Directorate ; and to draft material for the British Standards Institution and the Codes of Practice Committee of the Ministry of Works and Planning, to be used in the promulgation of official British Standards and Codes."

SECTIONS

In order to facilitate the closest scientific study of the whole field and to facilitate intelligent and effective contact between the Standards Committee and the various Study Committees, the work of the Committee has been viewed as falling into four categories :—

Practice.—(Dealing with requirements, plan elements, codes, terminology and other professional matters, with special reference to the activities of the Codes of Practice Committee.) Sir Giles Scott, C. Roland Woods, F. R. Hiorns, Guthlac Wilson.

Designs.—(Dealing with all manufactured parts, structural units, components and equipment.) J. W. Laing, G. Grey Wornum, Edwin Williams.

Materials.—(Dealing with all materials, with special reference to the activities of the British Standards Institution.) P. Good, Dr. F. M. Lea, T. Stevenson.

Prefabrication.—(Dealing with the technical, economic, and practical appraisal of the possibilities of prefabrication.) G. B. Sankey, G. Grey Wornum, Robert Chalmers, F. R. Hiorns, Francis Lorne, John H. Markham.

The following associations, by invitation from D.P.W.B., have discussed or are discussing machinery for consultation and collaboration with the Standards Committee. It is expected that each association will appoint a *liaison* representative.—National Brick Council, Clay Block Association, British Iron Founders' Association, British Metal Window Manufacturers' Association, English Joinery Manufacturers' Association, British Sanitary Fireclay Association, British Sanitary Earthenware Manufacturers' Association, Asbestos Cement Manufacturers' Association, British Cast Concrete Federation, Galvanised Tank Manufacturers' Association, Brass Founders Employers' Association, British Steelwork Association, British Door Manufacturers' Association, British Furniture Trade Employers' Confederation, Midland Lock and Latch Association. It is realised that standard designs, produced for the domestic building market, may provide important opportunities for the export trade. But the needs of that trade must be fully appreciated when the standards are prepared ; disregard of those needs might injuriously affect the trade. The National General Export Merchants' Group and the Association of British Chambers of Commerce have accordingly been invited to appoint each a *liaison* representative for the Standards Committee

The members of the Committee are as follows :

Chairman : Sydney Tatchell, F.R.I.B.A.
Secretary : F. R. S. Yorke, A.R.I.B.A.
Technical Officers : F. MacManus, A.R.I.B.A., C. R. Fowkes, A.R.I.B.A.

NOMINATED BY :

Ministry of Health :
S. Pointon Taylor, F.R.I.B.A. (Architect).
Department of Health for Scotland :
R. H. Matthew, A.R.I.B.A. (Deputy Architect).
D.S.I.R.:
Dr. F. M. Lea, D.Sc. (Principal Scientific Officer).
L.C.C.:
Edwin Williams, M.A., F.R.I.B.A. (Architects' Department).
Association of Municipal Corporations :
J. Nelson Meredith, F.R.I.B.A. (City Architect, Bristol).
National Federation of Housing Societies :
Reginald Browne, F.I.A.A., F.I.A.S. (Secretary).
British Standards Institution :
P. Good, M.I.E.E., F.C.G.I. (Director).
Codes of Practice Committee :
C. Roland Woods, M.B.E., LL.B. (Secretary).
R.I.B.A.:
F. R. Hiorns, F.S.A., F.R.I.B.A.
Institution of Mechanical Engineers :
Robert Chalmers, O.B.E., B.Sc., M.I. Mech. E. (Assistant Chief Engineer, L.C.C., Chairman of Mech. Inst. Committee).
Institution of Gas Engineers :
R. J. Rogers, M. Inst. Gas (Chairman of Gas Installations Committee).
Institution of Electrical Engineers :
E. A. Reynolds, M.A.
Building Materials Manufacturers' Association :
T. Stevenson (Temporary).
B.I.N.C.:
R. V. Chate, M. Inst. C.E. (Deputy : W. Cyril Cocking).
Ministry of Works and Planning :
Sir Giles Scott, R.A. (Chairman of Policy Committee, Design).
Ralph Freeman, M. Inst. C.E. (Chairman of Policy Committee, Structure).
G. Grey Wornum, F.R.I.B.A. (Chairman of Policy Committee, Installations).
G. B. Sankey (director, Joseph Sankey and Sons).
J. Laing (managing director, John Laing and Son).
Francis Lorne, F.R.I.B.A. (Assistant Director, Post-war Building).
John H. Markham, F.R.I.B.A. (Assistant Director, Post-war Building).
Guthlac Wilson (Director of Constructional Design).
C. R. Fowler, M.B.E. (Senior Architect, Works Division).

So that due regard may be paid to local conditions in various parts of Great Britain, six corresponding members will be appointed to represent East Anglia, the Midlands, the West Country, Wales, the North-East, and the North-West respectively. Scotland is already directly represented on the Committee. The corresponding members will not be expected to attend meetings, but will receive all agendas, minutes, and Committee papers, and will, whenever necessary, comment upon matters affecting or likely to affect local conditions and practices.

Mutual Aid for Small Tools

THERE has just been issued by the Machine Tool Control, in conjunction with the Regional Organisation Committee, a number of pamphlets explanatory of mutual aid schemes for small tools now in operation in all parts of this country and of a new procedure that is to be adopted in regard to them. One of these pamphlets gives complete information as to the division of the country into regions and the organisation within each of those regions, including the names and addresses of members of the Regional Committees and of the Cutting Tools Officer, and the names and addresses of the Chairmen of Mutual Aid Centres within the region. The other pamphlets are smaller and give information relating only to a single region.

In what follows we reprint from the pamphlets the preface explanatory of the whole working of the mutual aid schemes.

In order to ensure an even distribution of cutting tools and to make any surpluses available for immediate use, the Controller-General of Machine Tools in 1941 instituted a nation-wide survey of cutting tools, and a survey organisation was built up in each Region of the United Kingdom. The survey had two main objects :—

1. Obtaining information on the general causes of shortage or surplus of tools in any Region, from which observed tendencies future production of tools could be planned and co-ordinated.
2. Satisfaction of the most urgent demands and the relief of bottlenecks in production.

The survey organisation comprised the establishment in each of the twelve Regions of voluntary working committees under the chairmanship of the Machine Tool Control Area Chairmen. These committees consisted of representatives and executives of producers, distributors, and users of cutting tools in the Region, and the Machine Tool Control thus had immediately at its disposal advisory panels of men skilled and experienced in the tool industry.

Mutual Aid Exchanges were then inaugurated following a proposal and trial in the Midland Region. A number of firms were invited to attend meetings held in different districts of the Region and to present at these meetings details of their immediate and most urgent shortages, also giving details of tools which they were prepared to loan or sell to any other firm who might be in urgent need of them. The meetings were presided over by the Chairman, who called on each member in turn, and something like 80 per cent. of the demands put forward were satisfied then and there. The two parties to the transfer were put into direct contact, and, apart from a note of the transaction, no official paper work was involved. The scheme was an immediate success and the organisation of these Mutual Aid Exchanges has now been gradually extended over the whole country. Within a few months of the start of the scheme more than 100 of these Mutual Aid Exchanges met at regular intervals, and their local centres were in full and successful operation.

The regional basis of the scheme has been maintained and extended. There are now in each Region standing Cutting Tools Committees, under the chairmanship of a Cutting Tools Area Chairman and whole-time Cutting Tools Officers. These Officers are responsible to the Machine Tool Control for all matters concerning the manufacture, supply, and distribution of cutting tools, jigs and gauges, within each Region. Mutual Aid Exchange Centres will be based on the District Offices of the Regional Organisation, and the District Exchange Chairman and the Regional Cutting Tools Officer will attend District Mutual Aid meetings for the purpose of handling the section dealing with cutting tool problems. They will maintain close *liaison* with the main Cutting Tools Committee and their Regional Centre, to which urgent demands which cannot be satisfied at the District Meetings will be sent.

As a result of returns of surplus stocks of tools throughout the United Kingdom, which were rendered compulsory under the Cutting Tools Order (S.R. & O., 1942) (No. 77), which came into force on January 31st, 1942, the Machine Tool Control has now available a general picture of the surplus tools available in all Regions. These returns have been classified and indexed for quick reference, and will form the basis of working. The procedure involves the use of one single form so far as the Mutual Aid Exchanges are concerned, and a triplicate series of forms for use either at the Regional Centre or Headquarters, depending on where the bottlenecks are ultimately solved.

The procedure described below has been evolved with the object of putting the Mutual Aid Organisation generally on a more unified and efficient basis.

PROCEDURE AT MUTUAL AID EXCHANGES

1. Mutual Aid Exchange meetings will be convened by an official postcard.
2. The usual procedure followed at Exchange meetings will remain unchanged.
3. The Exchange Chairman, who will be assisted by the Regional Cutting Tools staff, will complete the form USD.1 for every firm making a bottleneck demand which cannot be satisfied at a Mutual Aid meeting. This will also apply to demands telephoned or communicated during periods between meetings.
4. The number of bottlenecks cleared at each Exchange and during the period between that meeting and the preceding will also be communicated to the Regional Cutting Tools Officer.
5. Offers of surplus tools made at Mutual Aid meetings will be entered on a surplus return form for recording and indexing at Regional Centres and Headquarters.

PROCEDURE AT REGIONAL CENTRES

1. On receipt of forms USD.1 from the Mutual Aid Exchange, the Cutting Tools Officer will have the unsatisfied demands examined against his records of tools available in the Region.
2. The Cutting Tools Officer will take the necessary action, at his discretion, to submit the demands to other Mutual Aid Exchanges in his Region.
3. If the demand can be satisfied by a supplier within the Region, particulars of such demands will be transferred to the triplicate series of forms BNC.1A, 1B, 1C, the functions of which are as follows :—

Form BNC.1A is an advice to the firm requiring assistance that the tools can be obtained from a named supplier to whom the requesting firm's official order should be sent.

Form BNC.1B is a corresponding advice to the supplier and incorporates a section in which the supplying firm will state their remaining stock of tools available after the order is filled.

Form BNC.1C is a record of the transaction for attaching to USD.1 and filing with it.

PROCEDURE AT HEADQUARTERS

If the demand cannot be satisfied from the Regional records, the form USD.1 will be transmitted from the Regions to M.T.C. Headquarters, where records are kept of all surplus stocks of tools in the United Kingdom. If the demand can be satisfied from these records, the same procedure will be followed at Headquarters as set out above. If the demand cannot be satisfied from these sources, Headquarters will either place the tools on order for best delivery or circulate to Mutual Aid Centres in all Regions. The Region will be notified immediately which course is being followed.

In order that the Regional and Headquarters records shall be kept up to date, form BNC.1B must be returned by the supplier to M.T.C. Headquarters through the Cutting Tools Officer for the supplier's Region. The space provided for return of tools remaining in the supplier's stock must always be completed.

The Gauge and Tool Makers' Association, Limited

A TRADE association, known as the Gauge and Tool Makers' Association, Ltd., has recently been formed under the presidency of Mr. H. H. Harley, of the Coventry Tool and Gauge Company, Ltd. The purpose of the Association is to further the interests of manufacturers engaged in gauge and tool making and to promote co-operation between them.

The management and control of the business and affairs of the Association are vested in a Council, which has the power to elect members to the Association, or to refuse any application without stating any reason. All individuals or firms carrying on business on their own account or members of a firm manufacturing gauges and tools are qualified to become members. Four sections have been established, and prospective members will select the section or sections into which their products fall. The sections are :—Gauges and measuring equipment ; jigs, fixtures, and special tools (excluding standard catalogued cutting tools) ; press tools ; moulds and dies. New members must be nominated by three members of the Association, with the exception that the Council has the power to elect the first thirty members without nomination.

The amount of the annual subscription will be determined from time to time by the Council, and will vary according to the annual turnover of the member firm. The policy of the Association at present is to admit manufacturers only.

The Council of the Association consists of elected members, co-opted members, and *ex-officio* members. Each section has the right to nominate one or more members to the Council, according to the size of the section, and at least four Council meetings a year must be held. The Chairman and Vice-Chairman of the Association also fill these offices on the Council ; this year, Mr. F. W. Halliwell, Gays (Hampton), Ltd., and Mr. H. S. Holden, Brooke Tool Manufacturing Company, Ltd., are Chairman and Vice-Chairman respectively.

The Secretary of the Association is Mr. A. P. G. Walters, of 5, Great Winchester Street, London, E.C.2, to whom all inquiries regarding the Association and membership should be addressed.

The objects for which the Association has been established are set forth in the Memorandum of Association as follows :—

(*a*) To constitute, provide, and maintain a central national organisation for the support and protection and to further the interests of and promote co-operation between all those engaged as manufacturers or as otherwise specially provided for in these presents in the gauge and tool making and allied industries (all of which are hereinafter referred to as and included in the expression "the industry").

(*b*) To place before Government and Government officials and others either in the British Empire or elsewhere the views of members of the Association and others upon matters affecting the industry.

(*c*) To further mutual assistance on technical and industrial problems and to make representations to Government and Government officials and others either in the British Empire or elsewhere upon inspection procedure, specifications, materials, and all matters appertaining to the industry.

(*d*) To take all necessary steps to obviate uneconomic and wasteful competition amongst the members, to develop the growth and maintain the efficiency of the industry.

(*e*) To consider and to take any action which may be deemed appropriate on any matters of commercial and trade practice in the interests of members.

(*f*) To obtain any Royal Charter, Provisional Order, or Act of Parliament or other authority either in the British Empire or elsewhere for enabling the Association to carry any of its objects into effect and to institute, promote, support, or oppose legislation or other measures or proceedings affecting the interests of the industry, and generally to consider questions concerning it.

(*g*) To act as arbitrator or to appoint arbitrators to act in the settlement of disputes arising out of transactions in or relating to the industry.

(*h*) To affiliate as an Association *in toto* or as a section of the Association with any other organised body or bodies having objects similar to those of the Association.

(*i*) To further the objects herein contained or any of them by acting directly or indirectly through (or by promoting co-operation between or co-operating with) any other organised body or bodies whatsoever in any part of the British Empire or elsewhere, and by appointing members of the Association and others to represent the Association on any such body or bodies.

(*j*) To promote, found, support, or finance any other company or organised body in any part of the British Empire or elsewhere for the furtherance of the objects herein contained or any of them, but so that no financial support or assistance shall be given to any company, in which any member of the Association is a shareholder or otherwise interested, unless such company shall prohibit the distribution of its income and property amongst its members to an extent at least as great as is imposed upon the Association by the provisions of Clause 4 hereof.

(*k*) Subject to the provisions of Section 14 of the Companies Act, 1929, to purchase, take on lease, hire, or otherwise acquire, for the purposes of the Association or as an investment of its funds any real or personal property and to maintain, improve, and develop and dispose of the same.

(*l*) To borrow and raise money and to secure or discharge any debt or obligation of or binding on the Association in such manner as may be thought fit and in particular by mortgages or charges upon the undertaking and all or any of the property and assets of the Association.

(*m*) To do all other lawful things incidental or conducive to the attainment of the above objects of the Association.

Provided that the Association shall not support with its funds any object or endeavour to impose or to procure to be observed by its members or others any regulation, restriction, or condition which if an object of the Association would make it a trade union.

Sixty Years Ago

THE MANCHESTER SHIP CANAL

OVER a hundred years ago one couplet of a popular song declared : "And this be true, Sirs, I'll bet you a crown, Manchester shall be, Sirs, a seaport town." Nevertheless, the years went by and the great volume of trade flowing between Manchester and Liverpool remained at the mercy of the railway companies owning lines between the two cities. There were no fewer than five separate railway routes, and the companies owning them were united in maintaining high transit charges. By 1882 the annual cost of overland transport between Manchester and Liverpool was estimated at between two and three million pounds. It was alleged that the charges per mile levied by the railway companies were nearly four times as much as those applying to goods transit between Manchester and Glasgow. The merchants and manufacturers of the district felt helpless to remedy their plight. Proposals were made to develop a wagon and horses road service between the two cities, to establish a plate railway suitable for ordinary road wagons, and to construct a ship canal. It was, however, realised that any of these schemes would meet with the intense opposition of the railway companies, who would reduce their rates until the promoters of the new venture were forced into bankruptcy or into agreement with the companies' oppressive tariffs. The merchants and manufacturers continued to bear their hard burden without a prospect of remedy until June, 1882, when a body of them, headed by Daniel Adamson, once more took up the question of constructing a ship canal. The scheme was pursued with vigour and determination, and very soon two engineers, Mr. Hamilton Fulton, of London, and Mr. Leader Williams, of Manchester, were appointed to survey and report upon a practicable route for the proposed canal for ocean-going ships. Within two months these gentlemen presented their reports. Mr. Fulton recommended the construction of a canal which would be tidal all the way from Liverpool to Manchester. Mr. Williams reported in favour of improving the existing tidal portion of the river from Garston to Latchford, making the portion from Latchford to Irlam semi-tidal, and constructing a ship canal with locks between Irlam and Manchester. In our issue of October 6th, 1882, we reported that Mr. Williams' scheme had met with the approval of the consulting engineer, Mr. James Abernethy, and that it had been adopted by the promoters. It was estimated that the works involved would cost about 5½ million pounds and would take four years to complete. It only remained to obtain parliamentary sanction to the scheme and to raise the funds required to carry it out. To safeguard the advantages to be obtained from the canal after it was built, it was urged that Parliament should require the railway companies to refrain from using their enormous power to destroy the competition of the canal with the railways.

A BIG SURFACE PLATE.—A Canadian works at Kitchener, Ont., has completed what is thought to be the biggest surface plate yet made in the Dominion, at any rate with a high degree of accuracy. Measuring 48in. by 60in., it is built on the cantilever three-point suspension principle and has an accuracy of 0·0003in. It is made of nickel-molybdenum iron, which in conjunction with its construction is considered practically to eliminate creepage, an important factor in surface plates.

Markets, Notes and News

The prices quoted herein relate to bulk quantities. Unless otherwise specified home trade quotations are delivered f.o.t. Export quotations are f.o.b. steamer

Galvanised Iron and Steel Wire

To secure further economies in the use of zinc, the Non-ferrous Metals Control has issued an instruction to manufacturers requiring a reduction in the amount of zinc used in the manufacture of galvanised iron and steel wire. As from September 24th, 1942, raw materials licences for zinc will not be granted for the production of galvanised wire except in the following cases :—(A) Fully galvanised wire may be produced and supplied only for the manufacture of wire ropes and wire strand, wire netting for Sommerfeld track, electric cables in cases where the use of fully galvanised wire is specially authorised by the Cable Planning Officer, Ministry of Supply; (B) wiped galvanised wire may be produced and supplied only for the manufacture of telephone, telegraph line and earth wires (single wire), manufacture of all types of electric cable, manufacture of chain link fencing and patent steel fencing, fencing wire, agricultural barb wire, point wires on War Office barb, hose armouring wire and binding wire, paper clip wire, wire for wire staples, spoke wire, box strapping wire, straining wires for Nissen huts, link, hook, chain and mat wire, wire for the manufacture of woven wire mesh. As an alternative to wiped galvanised wire, electro-galvanised wire may be produced and supplied for the above purposes, provided that the maximum coating of zinc on such wire does not exceed by more than 2½ per cent. the following weights :—Diameter of stripped wire : 0·014in. to 0·073in., 0·15 oz. per square foot ; 0·074in. to 0·127in., 0·30 oz. per square foot ; 0·128in. and thicker, 0·40 oz. per square foot. There may be some cases other than those covered by lists (A) and (B), in which the use of galvanised wire is essential. Such exceptional cases should be submitted to the Iron and Steel Control, Director for Wire Rods and Wire Products, for prior approval. Application for such approval should be made by the user of the wire and the letter of application must give the following details : (*a*) Purposes for which the wire is to be used, (*b*) quantity and size, (*c*) name of wire manufacturer from whom supplies are to be obtained, (*d*) steel authorisation or licence references. No wires other than those listed in (A) and (B) may be supplied in galvanised finish, except under such special authority. If approval is granted a special authority will be issued by the Iron and Steel Control to the user, and particulars of this must be passed on to the manufacturer. It will be necessary for manufacturers to obtain from customers full details of the purpose for which wire is required. In so far as orders in hand are concerned, these may be supplied as ordered provided that the delivery is made prior to November 1st, 1942. All deliveries made on and after that date must comply with the new restrictions.

The Pig Iron Market

There appears to be ample supplies of raw materials and the pig iron industry should be enabled to maintain a high rate of production. Imports of foreign ore have been considerably reduced, largely because the home production has been so greatly increased and efforts are being made continually further to expand the output. The demand for foundry pig iron is active, but there seems little likelihood of the requirements of the light castings foundries increasing, since few of them are working full time. On the other hand, some of the heavier foundries are taking larger quantities than recently. The concentration plan for the foundry trade has not been making rapid progress, and there is a tendency amongst consumers to buy on a hand-to-mouth basis until the effects of the scheme can be seen more clearly. The demand for pig iron is principally for low-phosphoric and refined irons, which are used as substitutes for hematite, and other irons which are in restricted supply. Hematite pig iron is only released when no other descriptions of pig iron will answer the purpose for which it is required. Recently several furnaces have been transferred from the production of foundry iron to basic pig iron. The demand for the latter is increasing, but it is probable that the turnover has been made in the expectation that when the concentration scheme comes into force consumers' requirements of foundry iron will be reduced. The Midland pig iron producers are understood to have accumulated considerable stocks and are in a position to give early delivery. On the other hand, consumers, for the reasons already given, are not pressing for supplies. The most active buyers at the moment appear to be the heavy electrical engineers and the machine tool foundries. These are taking good quantities and seem likely to be the mainstay of the foundry pig iron market for some time. The Scottish production of pig iron is satisfactory and more of this iron would be used by English consumers were licences more easily obtainable.

Midlands and South Wales

Activity at the Midland iron and steel works is unrelaxed. The call for special steels remains a feature of the market and they are wanted in large quantities by the engineering works producing munitions and armaments. Although the productive capacity of the country has been greatly expanded, it seems likely that further capacity will be needed fully to meet the demand. The engineering industry is also taking big tonnages of bars, particularly of the large diameters. There is, however, an important business in small bars, while recently there has been a noticeable demand for cold-rolled strip. The change for the better which recently occurred in the structural steel department is well maintained, and most of the producing works have benefited. The medium and light sizes are in strong demand, and although the improvement has also spread to heavy joists, business in these is not so active as it might be. The plate mills are operating under great pressure. In addition to the heavy requirements of the shipyards, the tank makers and boilermakers are important buyers, whilst a sharp request has sprung up from the constructional engineers. In general, the constructional engineering industry is in a better position than only a few weeks ago and has received a number of important Government orders. The situation in the sheet branch of the industry is satisfactory, and most of the works have sufficient orders in hand to keep them busy for several months. The work in hand consists largely of sheets of special quality for Government departments, but there has been an improvement lately in the demand for painted sheets, which shows that, owing to the restrictions on the manufacture of galvanised sheets, these substitutes are being used more extensively. Supplies of scrap are satisfactory and there is a good demand for the heavy classes. But complaints have been received of the quality of some of the lighter grades which are available. The iron and steel industry in South Wales is working at high pressure. There is a much stronger request for structural steel, but the demand for the heavy descriptions is somewhat quiet. Although the production of semis is at a high rate, the demand absorbs all the materials available. Business in sheet and tinplate bars has been more active lately, largely as a result of an extension in the requirements of the sheet makers. Only a restricted business is passing in tinplates, chiefly for substitutes for the normal descriptions. Export business is only small, and is conducted under great difficulty, and the home demand has been of a limited character.

Scotland and the North

The Scottish steel works are fully employed and most of them are well booked until the end of the year. There has been no relaxation in the pressure from consumers, which is apparent in all sections of the industry. The chief feature of the demand is for ship, tank, and boiler plates and alloy steels, as it has been for several months. The call for ship plates is abnormal and very large tonnages are passing to the shipyards, but the tank makers also are taking up good quantities and lately the requirements of the constructional engineers have increased. Business in steel bars, which has been on a considerable scale for some time, appears to be growing. Large tonnages are passing to the engineering industry, which is almost entirely engaged upon war work, and although there is a noticeable demand for the larger size bars, small steel bars are in strong request. Recently, however, there has been some decline in the volume of business in ferro-concrete rods. The re-rolling industry is, for the most part, fully engaged, although a few firms would be glad to obtain some business. The re-rolling industry is well situated as regards raw materials and, in spite of the big consumption, is obtaining all the billets required. The sheet works in Scotland have plenty of work on hand, including some substantial Government contracts. Great activity rules in the Lancashire steel trade. As in other districts, there is an insistent call for plates. The volume of business in sheets, however, has declined somewhat, but the makers can afford to regard this movement with indifference, since they have a big tonnage of work in hand, largely for Government departments. The demand for steel bars is maintained and there is a sharp request for bright-drawn bars, the producers of which are indicating extended delivery periods against new inquiries. The collieries continue to absorb considerable quantities of steel in the shape of arches, roofing bars, and light rails. The iron and steel industry in South Wales is largely employed upon the production of steel material for essential purposes. The greater proportion of orders in hand are high priority, and the producers are hard pressed to maintain their deliveries. Supplies of raw materials, however, are satisfactory. The recent improvement in the demand for joists and sections has been maintained, and most of the works in this section of the industry are well employed.

The North-East Coast and Yorkshire

Orders which followed the steel allocation for the fourth period have increased the pressure upon the steel works. Practically every department is operating at capacity and the tendency for delivery dates to lengthen in the case of one or two descriptions is noticeable. Steps, however, are being taken to restrict this tendency, and their effect should be seen shortly in the plate department, in which congestion appears to be most threatening. The insistent demand for basic steel is unabated and the resources of this branch of the industry are fully taxed. There is also an undiminished demand for acid carbon steel. The production of billets on the North-East Coast has reached a high level, but the demand for billets and sheet bars seems to be steadily increasing and consumers have still to use a proportion of imported material. The business in structural steel is better than it was, say, a couple of months ago, but most of the mills producing this material could undertake additional orders. The change in this branch of the industry is principally due to contracts given by the War Office and Air Ministry. Steel bars are in urgent request, but the pressure of demand is chiefly felt in the use of the large diameters. Re-rollers are well employed and are producing large tonnages of small steel bars, which are passing immediately into consumption. All the Yorkshire steel works are fully employed and in many cases their order books are comfortably filled until the end of the year. In this area the pressure is particularly strong for alloy steels, which are eagerly taken up by the aircraft manufacturers and munitions makers. Notwithstanding the great increase in the productive capacity of this branch of the industry, the demand appears to be still somewhat in excess of output. Large quantities of substitute descriptions of high-speed steel are passing into consumption. There is, of course, some work for which only high-tungsten steel is suitable, and for these cases supplies are available, but the quantities released are extremely small.

Iron and Steel Scrap

The many drives and expedients to obtain scrap for the iron and steel industry are bearing fruit and abundant supplies are reaching the distributing trade. In fact, so heavy is the flow of material that in some cases stockyards are overcrowded. The weakness of the position, however, is that so large a proportion of the material coming to hand consists of inferior grades and there are complaints that the proportion of heavy scrap is becoming smaller, whilst the amount of light scrap available is increasing. There exists for the time being an urgent demand for heavy prepared scrap, which cannot always be fully satisfied. Another snag is that the transport position appears to be somewhat congested, and this also acts as a hindrance to business. The principal demand is for first-grade heavy steel melting scrap and hydraulically compressed steel bundles. In most districts there are large supplies of railings scrap available and consumers have, during the past few weeks, received as much of this quality as they require. As an indication of the thoroughness of the drive to obtain railings, it is stated that from Lancashire and Yorkshire alone 43,000 tons have been collected. There is a steady flow of engineers' turnings to the yards, but these are meeting with only a limited demand. Most consumers are well stocked, but are still eagerly taking up supplies of heavy steel scrap and are adding these to the stocks they have in hand. It has become evident recently, however, that larger quantities of heavy steel, suitable for acid steel making, would be welcomed by consumers. An active business is passing in heavy wrought iron scrap, and there is a strong demand for heavy machinery quality. Ironfounders are, for the most part, able to satisfy their requirements, but some of them regard the future with some concern, as there are indications that the position may become rather more stringent. Perhaps, for this reason, there is a steady demand for all descriptions of cast iron scrap, which, at the moment, is being fully met.

Notes and Memoranda

Rail and Road

Japan and Railway Transport.—Tokyo has recently claimed that the 1941 output of locomotive and wagon building by Japanese companies reached a total of 1210 locomotives and 8882 wagons and coaches, of a total value of 84,600,000 yen.

Plywood in Place of Steel.—The Canadian Pacific Railway is building 750 box wagons and is lining them with stout plywood, instead of steel plates. The plywood is bolted in place by steel flats. The joints between the steel flats and the plywood are sealed with cement, to prevent the lodgment of water and dust.

Transportation of Minerals.—The Delaware and Hudson Railway Company is building a single-track line to link North Creek to Lake Sanford, in Northern New York. This will reopen and develop the titanium-bearing iron ore mines, now owned by the National Lead Company. The project is expected to add 100,000,000 tons of ore to the U.S.A.'s war production.

Railway Abandoned.—The abandonment of the 121 miles of line between Lucin, Utah, and Corinne Junction, on the Southern Pacific Railway of America, has been authorised by the Interstate Commerce Commission. The line has an historic interest as forming part of the first through railway in 1869 to the Pacific Coast. Its usefulness disappeared when the Southern Pacific completed a short cut across the Great Salt Lake.

Transport in Ceylon.—In an effort to save fuel and wear and tear, especially of tyres, the Director of Transport in Ceylon has reorganised road transport in the island, where there are 3000 licensed lorries. These have been formed into eighty-three groups, mainly on a geographical basis, to each of which a group organiser has been appointed, whose job it will be to co-ordinate the work in his area and co-operate with his colleagues and the military authorities, who have secured some of the lorries released under the scheme.

War Transport in South Africa.—The South African Ministry of War Transport has become the largest single organisation in the Dominion. It now employs 130,000 persons, and its many workshops are staffed and equipped on a scale and for a range of manufacture not to be found elsewhere in Africa. The Ministry controls 13,000 miles of railways and 17,000 miles of road transport, as well as the ports, where the handling, provisioning, and repair of naval and merchant vessels is undertaken. No fewer than 11,000 railwaymen are serving in the fighting Forces.

Saving Rubber on Railways.—Some time ago the Association of American Railroads appointed a special joint committee of the Mechanical and Purchases and Stores Division to study possible savings in the use of rubber by American railways. This committee has reported that without interfering with safety or efficiency, fibre, plastics, felt, reclaimed rubber, and various other materials can be used in making approximately 170 different parts and appliances which now use rubber. In the manufacture of nearly seventy other items made either entirely or partially of rubber the committee found that the amount of this material can be reduced.

Air and Water

The Next Tennessee Valley Authority Dam.—Four months after authorisation, the first bucketful of concrete has been tipped into place on the Tennessee Valley Authority's Douglas Dam, on the French Broad River. Douglas Dam, which is to cost 30,000,000 dollars, will be almost an exact duplicate of Cherokee, and is expected to be completed by the autumn of next year.

A Stone Bridge.—A bridge, nearly 500ft. long, with a 24ft. roadway, was a detail in a recently constructed 25-mile war road in Palo Pinto County, Texas. Using a local stone, nineteen arches were built in and over the Brazos River west of the town of Mineral Wells. The new bridge was designed to reduce the weight of steel used to a minimum, and no more than 16 tons were needed.

Edmonton to Alaska.—The announcement of the approaching completion of the Canada-Alaska highway has added interest to a proposal by the Swedish explorer Stefansson to link up Alberta with the Bering Straits by a combined road and waterway route. The explorer has shown that only a low divide separates the Mackenzie River from the Yukon, and if that were crossed by a highway the great rivers would serve in warm weather as roadways for ships and barges, while in winter the thick ice on them would carry lorries without difficulty. The Mackenzie River rises near Edmonton and has been called "the historic commercial highway of North-Western Canada." Its navigability begins at a railhead north of Edmonton, but because it empties into the Arctic Ocean its utilisation is restricted. The River Yukon flows in the same general direction and debouches into Bering Sea. The main advantage of the proposal is that a practical, heavy traffic route would be available in a short time.

A Cross-Scotland Waterway.—Answering a question in the House of Commons, the Secretary of State for Scotland did not throw fresh light on the proposal to construct a sea level canal capable of conveying battleships from the Clyde to the Forth, which was the subject of a report by a committee appointed in 1929 by the Minister of Transport. The report was published in August, 1930. Mr. Johnston promised no more than to maintain close contact with the Minister of War Transport on all proposals for transport development in Scotland.

Miscellanea

The Rotting of Sand Bags.—The Australian Cement Manufacturers' Association has been experimenting with the addition of cement to sand to prevent the collapse of the contents of a sand bag, even though the bag may rot, and recommends the addition of cement to the sand, in the proportions of 1 to 15.

The U.S.A. Machine Tool Output.—The United States are now turning out, week by week, as many machine tools as were manufactured in twelve months ten years ago. It is estimated that the industry will produce more than 200,000 during the current year, which has already beaten the 1941 record output.

Molasses for Fuel.—The annual production of molasses in India amounts to about 275,000 tons. In view of the shortage of petrol and fuel oil, public opinion is urging that molasses should be used to the fullest extent if the necessary plant can be obtained at reasonable prices. The Government of India is prepared to assist in obtaining priorities for the supply and shipment of power alcohol plants to individuals and firms in India interested in the speedy production of power alcohol from molasses.

New Uses for Wool.—An Australian inventor claims that wool, properly utilised, will deflect bullets. His experiments seem to show that a bullet cannot penetrate a bale of wool more than 1½in., and he has designed a bomb shelter with a double-skinned steel roof and walls, the space between to be filled tightly with rammed wool. He visualises the application of this principle to bullet-proof vests for the troops, and is at present working on wool-pressed "mattress" for protection of fighter pilots.

The Junior Institution of Engineers.—The Council of the Junior Institution of Engineers has made the following awards in respect of papers and lectures delivered during 1941–42:—The Institution Gold Medal to R. L. Hunt, for his paper "Practical Combustion on Travelling Grate Stokers"; the Institution Silver Medal to A. V. Jobling, for his paper "The Manufacture of Heavy Forgings in Alloy Steel"; the Vickers Gold Medal to O. J. B. Orwin, for his paper "Recent Developments in the Design and Manufacture of Emergency Industrial Gas Producers"; the Tookey Award to J. Foster Petree, for his paper "Some Technical Terms"; the Past Secretary Dunn Medal to H. J. N. Riddle, for his paper "The J.I.E. Epidiascope"; the Midland Section Silver Medal to A. Russell, for his paper "The Engineer in the Drop Forging Industry."

Personal and Business

Mr. G. O. Urion has been appointed assistant chief mechanical engineer, Nigerian Railway.

Mr. H. V. Coes has been nominated as President of the American Society of Mechanical Engineers for 1943.

Lieut.-Colonel Sir John Greenly has been nominated as President of the Institute of Metals for 1943–44.

We record with regret the death of Mr. George C. Pearson, late chief engineer of Johnson and Phillips, Ltd., Charlton, S.E.7.

The L.N.E. Railway announces that Mr. J. R. Dallmeyer, surveying and parliamentary assistant to the engineer, Southern Area, has been appointed district engineer, Ipswich, in succession to Mr. C. H. B. Smith, who is shortly retiring.

Mr. A. B. Handley has been appointed joint managing director of the Rotherham Forge and Rolling Mills Company, Ltd.

Mr. W. Wilkinson Wood, a director of the Wardsend Steel Company, Ltd., has been elected Master Cutler for the fourth time.

Mr. H. V. Bonar has been appointed Jute Controller, Ministry of Supply, in place of Mr. H. S. Sharp, who has resigned on account of ill-health.

The Minister of Supply has appointed Mr. D. M. Moffat, of Tube Investments, Ltd., to be Deputy Controller of Inspection Administration in the Ministry of Supply.

Forthcoming Engagements

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Monday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

Institute of Fuel

Tuesday, Oct. 13th.—Inst. of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2. Presidential Address, W. M. Selvey. 2.30 p.m.

Institution of Automobile Engineers

Sunday, Oct. 11th.—London Graduates: 12, Hobart Place, S.W.1. "A Post-war Motor Vehicle," L. H. Hounsfield. 3 p.m.

Institution of Chemical Engineers

Tuesday, Oct. 13th.—Geological Society's Rooms, Burlington House, Piccadilly, W.1. "The Production of Radium," E. F. MacTaggart. 2.30 p.m.

Institution of Electrical Engineers

Wednesday, Oct. 7th.—Wireless Section: Savoy Place, Victoria Embankment, W.C.2. Chairman's Address, R. L. Smith-Rose. 5.30 p.m.

Wednesday, Oct. 14th.—Transmission Section: Savoy Place, Victoria Embankment, W.C.2. Chairman's Address, P. E. Rycroft. 5.30 p.m.

Thursday, Oct. 15th.—Installations Section: Savoy Place, Victoria Embankment, W.C.2. Chairman's Address, R. Grierson. 5.30 p.m.

Institution of Engineers and Shipbuilders in Scotland

Tuesday, Oct. 20th.—39, Elmbank Crescent, Glasgow. Presidential Address, F. C. Stewart. 6.30 p.m.

Institution of Mechanical Engineers

Monday, Oct. 5th.—Scottish Branch: Royal Technical College, Glasgow. "Poison Gases," Professor W. M. Cumming; and "Physiological Effects and Treatment," Dr. A. Goodall. 7.30 p.m.

Friday, Oct. 9th.—Storey's Gate, Westminster, S.W.1. "The Training Activities of the Ministry of Labour," E. Watson Smyth. (Informal meeting.) 5.30 p.m.—Scottish Graduates' Section: Royal Technical College, Glasgow. "Wartime Effects on Engineer and Patent Law," R. W. Cunningham. 7.30 p.m.

Thursday, Oct. 15th.—Midland Branch: James Watt Memorial Institute, Birmingham. "Fencing of Machinery," H. A. Hepburn. 5.30 p.m.

Friday, Oct. 23rd.—Storey's Gate, Westminster, S.W.1. Presidential Address, "Boilers—Past and Present," Colonel S. J. Thompson. 5.30 p.m.

Institution of Production Engineers

Saturday, Oct. 10th.—Yorkshire Section: The University, Leeds. "High Speed in the Production Shop," Dr. G. Schlesinger. 2.30 p.m.

Saturday, Oct. 17th.—Manchester Section: Houldsworth Hall, Manchester. "Some Post-war Industrial Problems," Dr. A. P. M. Fleming. 2.30 p.m.

Junior Institution of Engineers

Friday, Oct. 9th.—39, Victoria Street, S.W.1. "Sinking and Erection of Cast Iron Tubbings," H. A. Hatt. 6 p.m.

Manchester Association of Engineers

Saturday, Oct. 10th.—Engineers' Club, Albert Square, Manchester. "Plastics and their Application to Engineering," J. Prior. 2.30 p.m.

Manchester Geological and Mining Society

Tuesday, Oct. 13th.—Queen's Chambers, John Dalton Street, Manchester. Annual general meeting. 2.45 p.m.

Men of Mauds1ays

Wednesday, Oct. 7th.—Inst. of Mechanical Engineers, Storey's Gate, Westminster, S.W.1. Special general meeting. 4 p.m. (Committee meeting, 3 p.m.)

Newcomen Society

Wednesday, Oct. 14th.—Iron and Steel Institute, 4, Grosvenor Gardens, S.W.1. "John Edwards (1731–1807), Cornish Industrialist," T. R. Harris; "Early Engineering and Ironfounding in Cornwall," Rhys Jenkins. 2.30 p.m.

Women's Engineering Society

Saturday, Oct. 3rd.—20, Regent Street, S.W.1. "The Technical Woman in the W.A.A.F.," Flight Officer G. Gilliam. 5 p.m.